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Cover Photograph: *Low altitude oblique aerial photograph of tropical forest in Thailand showing how the oblique viewpoint shows up the shape of individual tree crowns.*

Unasylva

An International Review of Forestry and Forest Products

FORESTRY AND COMMUNITY DEVELOPMENT

UNTIL comparatively recently in the history of mankind's evolution, the individual and the community to which he belonged co-existed in a mutually balanced *modus vivendi* governed by custom. The pattern can still easily be found in remote parts of New Guinea or of the Amazon basin.

In this scheme of things, the natural vegetative cover — usually the forest — came in for little consideration. It was there to be used. People believed in its exploitation, knowing that if they did not make use of it for their immediate needs, someone else would. Their needs were small, and the regenerative powers inherent in the forest were often given time to repair any damage done. But a policy of every man for himself did lead to the unhappiness of neighbors, and in the case of many communities only deserts remain as an epitaph.

Man is a creature whose individualistic instincts are predominant, and who resents planning for his well-being by a minority who believe they know what is best in the interests of collective happiness. Nevertheless, people are coming more and more to believe in planning.

When it is done for them by some outside agency without their active and enlightened co-operation, there often results an unequal, often biassed, distribution of emphasis, which is epitomized by such phenomena as soil mining, river pollution, forest destruction, the lowering of water-tables, the production of harmful fumes and radiations, wildlife extermination — in short, general abuse of the basic resources upon which life depends. There follows rural exodus, unplanned urbanization with its shanty town development, unemployment and the lowering of moral values, brought about by the modern trend toward excessive technical control on the one hand and dormant social control on the other by man of man and his environment.

Rapidly increasing populations merely serve to aggravate the situation. Industrialization has been suggested as a palliative, but progress here in underdeveloped countries immediately presents another serious problem in regard to stabilization and improvement of rural life. It tends to widen the social distances between urban-industrial communities and the agricultural populations — to throw off balance their traditional subsistence economy and impair their social and cultural integrity — to expose them to the danger of being thrown back to obsolete forms of social structure.

A great deal of attention has, in recent years, been focussed on community development as the modern answer to the general problem of combining technical with social contro in the interests of "the greatest good to the greatest number in the long run". The success of any such project depends upon a two-fold consideration: the conditioning of traditional public opinion to changes from without, and the conditioning of reformers to circumstances obtaining within the community affected. The plan established must combine, under local leadership and initiative, intimate knowledge of the environment and a sincere urge toward self-help, with outside technical information and stimulation. Community development, in other words, is primarily a question of education. Unless the help and technical guidance from outside is sufficiently enlightened to ensure an overall development of locally available natural resources, the stability and welfare of the community are bound to be compromised. And unless there is real awareness and understanding of the value of any such development by the community affected, the response given to the initial stimulus will be only partial and short-lived.

The planned re-establishment of natural vegetative cover, or its careful conservation and improvement, should constitute an essential part of any community development project. And yet it is true to say that forestry and tree planting have until now played little or no active part in such programs. This is the fault both of those responsible for the help and technical guidance brought in from outside, and of the community itself which has lost all awareness of the benefits it can derive from tree cover.

Advice aimed at improving local economic and social conditions in rural areas should be orientated to the needs of the rural family as a whole. An integrated service covering all fields of interest of an organization such as FAO is much more efficient for this purpose than a number of fragmented services each following its own policy.

FIGURE 1. *A Hunting Percival 'Prince' aerial survey aircraft. The two sets of doors open in the floor of the aircraft cover the bays for two aerial cameras situated in tandem. Above the rear camera bay is visible one of the side camera ports for oblique photography.*

FIGURE 2. *Swamp forest, mainly different species of mangroves near Port Swettenham in Malaya. Scale 1 : 5,000. Camera Wild R.C.5.*

The Use of Aerial Photographs in Tropical Forests

D. A. Francis
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Two of the many problems which face foresters in the tropics are connected with survey aspects of their work, and apply in particular to tropical rain forest areas. These problems are:

1. the location of merchantable timber;
2. its extraction by the most efficient and economic means.

A solution to both problems is the preparation of stock maps showing the distribution of merchantable tree species, and accurate topographic maps which can be used for the planning of extraction routes. By present methods, in most cases entirely on the ground, a considerable amount of costly field work is entailed and this means a slow rate of mapping to cover a given area.

Efforts have been made to speed up the rate of mapping and to produce maps more economically by the use of aerial photography in tropical forest areas. These efforts have met with a varying degree of success compared with the proved value of aerial photography in its application to many forest areas outside the tropics. The reasons for this will be apparent if the preparation of topographic and forest maps from aerial photographs is considered in detail.

In temperate forest areas the stages involved in the preparation of such maps are:

1. aerial photography;
2. photo-interpretation and compilation of a preliminary forest-type map;
3. field check of photo-interpretation and inventory of the growing stock, plus provision of ground control for topographic mapping;
4. final photo-interpretation;
5. compilation of maps by the use of photogrammetric instruments.

In tropical forest areas the same sequence is followed, but the following complications arise in the process:

(*a*) Aerial photography may only be possible at very limited seasons of the year because of cloud or haze.

(*b*) Photo-interpretation may prove to be of limited value if forest types or individual tree species are not readily identifiable on the photographs.

(*c*) Field checking may have to be delayed due to climatic or other circumstances, and identifiable photo-patterns visible on the aerial photographs are apparently inexplicable in the field.

Aerial photography of tropical forests

Tropical rain forest areas are notoriously difficult to photograph from the air. This may be due to cloud or haze or a combination of both hazards. Really clear weather is rare over such areas but, given good photographic weather, a large area can be photographed by a survey aircraft in a short time.

Survey aircraft will often have to wait for days, weeks or even months for a brief spell of clear weather in which to photograph a tropical rain forest area.

This naturally adds to the cost of such a survey even though every effort is made to position the aircraft at the optimum period for photography, chosen after examination of the available meteorological records.

The choice of season for photography in tropical rain forest areas is more often a question of photographic weather than vegetative condition of the growing stock. Almost all the tree species are evergreen and it is only when color differences are being photographed that season is considered from the botanical viewpoint. In this respect, aerial photography of tropical rain forest areas differs from the photography of drier tropical forests and of forests in more temperate regions.

The scale of photography used is of great importance to the forester as it determines, to a large extent, the amount of photo-interpretation which is possible.

For individual tree species identification it is necessary for the photographs to be at a relatively large contact scale, i.e., 1:20,000 or larger. Such large-scale photographs have the disadvantage, however, that they give a relatively restricted view of a particular forest area. Photographs at a smaller scale are of much greater use in the initial stages of photo-interpretation work in tropical forests as they give the overall view of a large area. The advent of the latest Swiss and German cameras which have lenses giving a particularly high quality resolution has led to the increasing use of smaller scale aerial photographs by photogrammetrists. Such high quality prints are also of great use to the forester for photo-interpretation. In such cases it is an advantage for the forester to have smaller scale photography for photo-interpretation in the first instance, delineate areas on this photography for further examination, and then recommend further large-scale photography of selected areas.

While it is possible to enlarge contact prints taken with the high resolution lenses, the trouble here is that most stereoscopes and photogrammetric instruments

are manufactured for use with about 23 × 23 centimeter aerial photographs. It is also more economic to work with contact prints whenever possible, as otherwise each negative has to be enlarged individually whereas contact prints are rapidly produced on a printing machine.

Modern mirror stereoscopes are fitted with binoculars for the magnified examination of selected areas on contact prints, and in most cases this optical enlargement of the photographic image will suffice for the forester. However, certain stereoscopes will accommodate up to two times enlargements of the contact prints and these are of value in particular cases where the existing aerial photographs are at too small a scale for detailed photo-interpretation.

For photo-interpretation, the writer prefers prints made on glossy unglazed photographic paper. This gives a sharp image and yet has a surface which will take a colored pencil for annotation purposes. Glazed prints have the best definition but this surface means that annotation has to be carried out with a wax pencil and fine lines cannot readily be drawn. Such pencils also have a tendency to melt in hot climates and are, consequently, unpleasant to use in the field.

On the question of the best film and filter combination to use for forest photography in the tropics, the writer's present recommendation is the combination used for "normal" black and white photography. This is Panchromatic film exposed through a minus blue (i.e., yellow) filter. A considerable amount of research has been carried out, and is still being undertaken, to determine the best film and filter combination for individual tree species identification (see following section). Nevertheless, the Panchromatic plus the minus blue filter combination gives the greatest overall tonal rendering over most tropical rain forest areas and is also best suited to the photography of tropical savanna forest areas.

Before leaving the problem of aerial photography in tropical forest areas, the use of supplementary oblique or large-scale vertical aerial photography should be mentioned. For mapping purposes vertical aerial photographs are now the universally accepted medium.

From the forester's aspect, this viewpoint may not be ideal as the side view of the individual tree crowns is often a distinctive characteristic. It is possible to equip an aircraft with either a forward-facing oblique camera, or with two sideways-facing oblique cameras, known as a "tri-camera" arrangement, to provide simultaneous vertical and oblique coverage of a forest area without the expense of flying twice over the same area.

A similar technique may be employed where the scale requirements of the photogrammetrist and forester differ. An area may be photographed from 6,000 meters above mean ground level, using a 6-inch. (about 15-centimeter) focal length lens to give 1:40,000 scale contact prints for the production of topographic maps. At the same time, and through a second camera bay in the survey aircraft, photographs may be taken through a 12-inch (about 30.5 centimeter) focal length lens resulting in 1:20,000 scale contact prints for interpretation purposes. It should be noted that the coverage of the longer focal length lens will not be complete in a lateral direction and the forester therefore carries out his photo-interpretation on the large-scale sample strip and extrapolates, where possible, on to the smaller-scale overall photography.

Photo-interpretation in tropical forests

The normal procedure in forest photo-interpretation is as follows:

1. A preliminary photo-interpretation is carried out by stereoscopic examination of the contact prints, giving an initial breakdown into forest types and, if possible, individual tree species.
2. A provisional forest type map is then compiled from the preliminary photo-interpretation to show the distribution of the different forest types or tree species. At this stage these may be indicated by letters or symbols and the map itself be in colored pencil on a transparent base.
3. A field check of this photo-interpretation is carried out. This usually incorporates a percentage enumeration on the ground to give volumetric data to apply to the stratification made on the aerial photographs.
4. A final photo-interpretation is then carried out of the photographs which have been ground checked in the field.
5. A final forest type map on a suitably controlled base map is made from the contact prints.

The procedure outlined above falls to the ground when a large block of apparently similar forest type is being surveyed in the tropics. Where there are no recognizable forest types on the aerial photographs or where forest types gradually merge into one another over long distances, then a preliminary breakdown by forest types in other than a very general way, becomes impossible. An analogy with a pack of cards may help the reader to visualize the problem. In the north temperate zones it is usually possible to identify the different forest types on the aerial photographs and to delineate these accurately on the prints. In other words, it is like dealing a pack of cards, face up, and sorting them into the four different suits. Further work on the photographs such as measurements of crown density, crown diameter, stand height, or individual tree heights may be regarded as resorting the different forest types in the same way that each suit in a pack of cards may be put in order.

In tropical rain forests, however, recognizable forest types are few and far between, and the forest type containing the majority of commercially valuable tree species may appear on the aerial photographs as one homogeneous type.

In these circumstances, to return to the previous analogy, it is like viewing a pack of cards reverse side up and endeavoring to select the joker. The joker in this

case being the one mature or overmature valuable tree appearing in each 50 or 100 hectares. There is no doubt that, for optimum use of aerial photographs in tropical forestry, it is necessary for the forester to identify individual tree species. However, present experience indicates that this can only be done in a relatively limited number of cases. If the forester is not able to recognize the commercially valuable tree species in a selected area, he may be able to recognize on the aerial photographs tree species which, while not of value in themselves, are indicators of richer or poorer forest types.

On panchromatic aerial photographs of a forest area in Ghana the only consistently recognizable tree species were the silk cotton (*Ceiba pentandra*) and the umbrella tree (*Musanga smithii*), neither of which are of any commercial value nor are they indicators of a valuable forest type, though *Musanga* does usually indicate regenerating forest.

Negative information is often useful for the forester in the tropics. Raphia palms indicate swampy areas and appear in situations where there are few commercially valuable trees. The palms show up distinctly on aerial photographs and the limits of such areas may be shown on the forest maps. These areas can be planimetered and their net area deducted from the total area of a map sheet when applying the results of ground enumerations on an area basis.

If there are only a limited number of recognizable vegetation patterns or individual tree crowns on the photographs, a further subdivision of the forest, by stereoscopic examination of the contact prints, into different site classes may be advantageous.

This is essentially a topographic stratification which can be reviewed when the results of field enumeration work are plotted on to the photographs. For example, it may be found that the maximum concentration of economic tree species is found on middle slopes and that the number of such trees found on upper slopes or in wide flat valleys is insufficient to justify exploitation. In these circumstances, the virtual elimination of costly enumeration work in selected sites by concentrating field work in the areas of greatest potential value would be an economy well worth the cost of photographing a forest concession. The accuracy of such photo-interpretation would of course have to be checked from time to time in the field and this would best be carried out by random sampling in reputedly "poor" forest areas.

So far it has been assumed that the forester carrying out the photo-interpretation has been using normal black and white photographs for interpretation purposes.

In view of the importance of locating individual trees of commercial value, research into the use of infrared and color film for species identification has been undertaken. The origin of this research was the writer's observation of the coppery-colored first flush of mahogany (*Khaya ivorensis*) in Ghana. From the ground the juvenile leaves appear to form a colored zone at the periphery of the crown and it appeared that this flush,

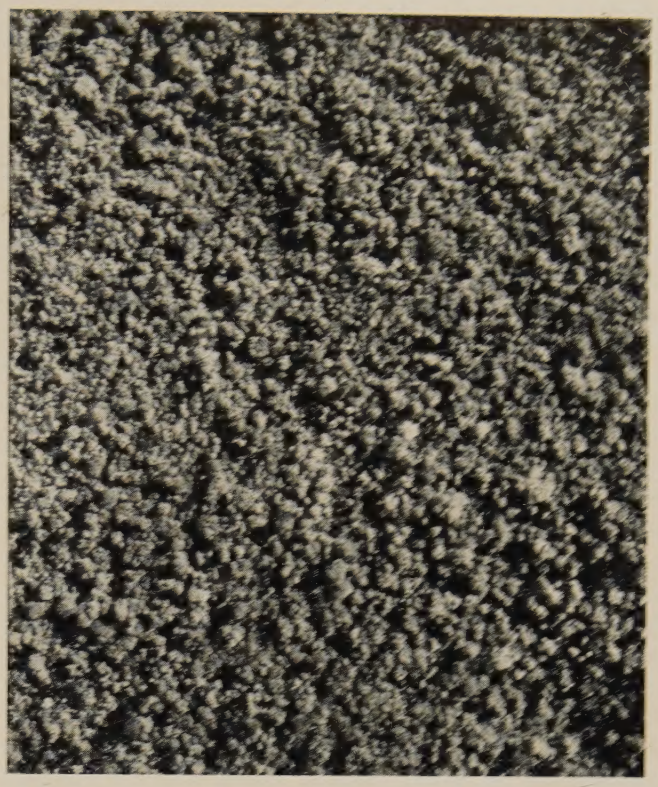


FIGURE 3. *Dense tropical rain forest in British Guiana showing relatively few tonal and textural variations in individual tree crowns. Scale 1 : 10,000.*

photographed from above, would be distinctive. Initial tests using 35-millimeter color film in a miniature camera were promising and resulted in further tests with aerial cameras and aerial color film.

There is now little doubt that a distinctive coloration in any tree species of the upper canopy can be recorded on aerial photographs by the use of color film. The problems are timing, weather and photography.

The first is that of the period for which the distinctive color persists, and is related to the consistency of flowering or flushing. A distinctive color rarely lasts for more than two weeks, and it is even rarer for it to be consistent over an area for the whole of this period. Individuals of a particular tree species may show their color difference at varying periods in tropical rain forests, and the optimum period for photography can only be assessed in the field during the season in which photography is being attempted.

In the tropics, this optimum period may coincide with a period of cloudy weather which may prevent photography.

The photographic problem includes deterioration of the color film, or the images recorded on it, by exposure to high temperatures and high humidities. Haze adds its effect in that the color contrast is lowered by haze over humid forest areas. The haze filter used to improve the color rendering of the film will also depend on the flying height of the survey aircraft, as color transparencies tend to be more blue as the flying height increases. Exposure is far more critical than with panchromatic film; this is a characteristic of color film.

which is also appreciably slower in emulsion speed than panchromatic. Processing of color film is made more difficult in the tropics by the critical temperature requirements of the color developers. These necessitate air-conditioned laboratories and temperature-controlled solutions and because of this, processing is usually carried out in a temperate climate.

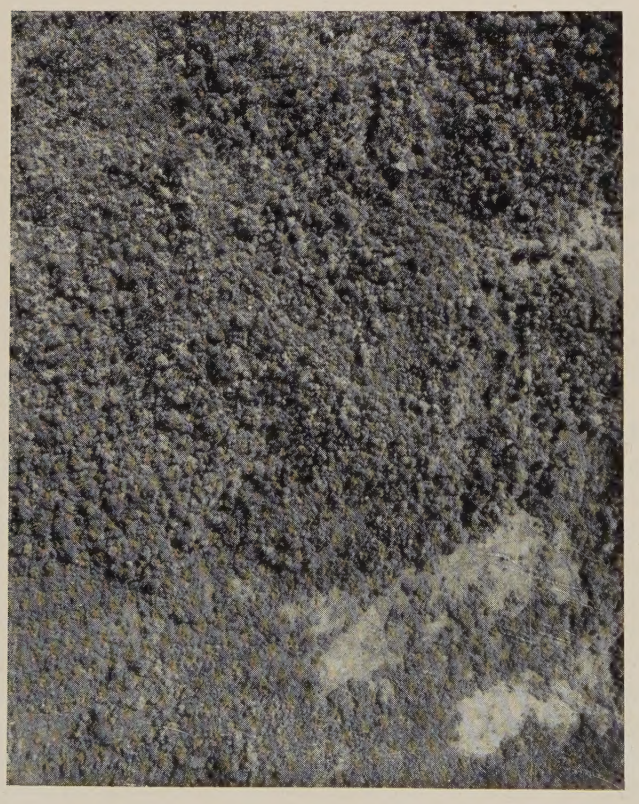
Despite all these objections to the use of color film it is, none the less, the most promising prospect for individual tree species identification in tropical forest areas.

Tests undertaken with color film over tropical forest areas in British Honduras and British Guiana have shown distinctive crown colorations. Unfortunately immediate ground checking of the color transparencies was not possible and without an early field check such experimental work is of little value. In temperate regions controlled tests have shown that noticeable crown colorations, e.g., copper beech, can be recorded satisfactorily on color film. A further research program to investigate more fully the potentialities of color film in tropical forest areas is being undertaken.

Color aerial phtography is at present appreciably more expensive than black and white. Its use can only be justified in the richer tropical forests where individual tree species of large dimensions and high values are found, and where ground conditions make field work difficult, expensive and slow.

Infrared film has been tried under tropical forest conditions but the results to date have shown no significant increase in the accuracy of individual tree species identification. This is surprising in view of the very real value of modified infrared photography to the survey of forest areas in North America.

FIGURE 4. *Dense tropical rain forest in Malaya showing many tonal and textural variations in individual tree crowns. Scale 1 : 15,000.*



Controlled experiments over a tropical forest area have not yet come to the writer's attention, but a certain amount of normal infrared and modified infrared photography in the tropics has been examined stereoscopically and in the field. From this material it would appear that pure infrared photography (i.e., infrared film exposed through a deep red filter) has more contrast than modified infrared photography (i.e., infrared film exposed through a minus blue filter) and that the former accentuates tonal differences in individual tree species.

The haze penetration effect of infrared photography, which would appear to be an advantage, is counterbalanced by the loss of shadow detail in the photographs and consequent obliteration of forest paths and small clearings. This leads to navigational difficulties when carrying out the field work.

Panchromatic film exposed through a red filter has also been tried in an endeavor to bring out color differences, but the tonal quality of the resulting points showed this technique to be unsuitable.

When the preliminary photo-interpretation is complete the forester has annotated prints, a key to his annotation, and symbols on a preliminary forest type map; the latter having been transferred from individual prints to the map when the prints were annotated. This enables the forester to see the grouping of any distinctive photo patterns. It is not necessary for him to have been in the field as the stratification is done purely on the basis of ocular identification. This ocular identification is later checked in the field.

It is emphasized that at this stage the forester does not know if the photo-patterns he has identified are, in fact, forest types, vegetation associations or tree species, but he has a distinctive pattern which needs to be followed up on the ground.

An aerial photograph mosaic, made by joining together individual contact prints to make an overall picture of a forest area, will prove to be of considerable use to the forester, as on this he can plan his field check of symbols " A - Z " to cover the greatest possible variety of photo-pattern in the least time. His routes can be plotted in advance on this mosaic to make the most economical use of his time in the field, and sites may be selected where a number of photo-patterns can be examined from one point.

Field check of photo-interpretation

The preliminary photo-interpretation, providing a stratification of the forest, should then be checked in the field. Such a check is essentially qualitative, the accuracy of the photo-interpretation being examined to see if the interpreter has been consistent, and to see if identifiable photo-patterns are related to observed conditions on the ground, and whether correlations noted are consistent throughout the area examined.

If the greatest benefit is to be obtained from the field check, it must be carried out by the forester who undertook the original photo-interpretation. It should also be carried out as soon as possible after the date of photography or, if this is impossible, at the same season as the photography. The reason for this is that, in tropical forests, individual trees of a particular species may be in a different floristic condition at the same time. In view of this, two individuals which have markedly different tones on a photograph because one is in full leaf and the other just coming into leaf when the photograph was taken, may appear to be identical when examined in the field some months later — and the differences appear inexplicable to the man carrying out the field check.

In tropical forests, the aim of the photo-interpreter should be to carry out a rapid examination of the aerial photographs as soon as possible after the date of photography and to follow this up with an early field check of the photo-patterns. In this connection, it may be of interest to foresters to learn that it is customary for the field crews of aerial survey firms to process the films on location, and to make one set of prints in the field to check that they have fully covered an area which has to be surveyed, thereby saving expensive re-flying at a later date. This proof set, while often not as well printed as the later set sent to the client, is quite adequate for field use. It has the great advantage of being only a few days old and, if the forester can obtain such a set, a field check to examine photo-patterns can be carried out at once and any tonal differences which occur within the same forest type or between individual of the same tree species can be seen and recorded.

For quantitative photo-interpretation the larger scale photograph is required, one on which individual tree crowns may be examined in detail. The minimum scale for such work in the tropics should be about 1:20,000 though there are indications that an even larger scale (1:10,000) is preferable as the shape of the individual tree crowns is important. The larger the scale, the closer the spacing of the flight-lines and the more expensive the work but, with ground survey work costing so much, the forester in the tropics may be forgiven if he demands a larger scale of photography than that required outside the tropics.

Individual tree species identification in tropical forests depends to a large extent on the skill of the forester carrying out the photo-interpretation, the quality of the photographs under examination and tonal variation in the trees themselves. It is considered advisable to give details of the quantitative check of the accuracy of the interpretation, e.g., out of 67 type 'A' tree crowns it was found that 65 were *Khaya ivorensis* and two other tree species, or, all 21 identifications of forest type 'B' were consistent, the dominant tree being identified as *Mitragyna inermis* and the forest type designated fresh water swamp forest.

In practice, the writer pricks through the print with a pin and writes brief notes on the reverse side of each print and more detailed in a separate book.

During the field check, notes are made on major vegetation changes, site type, etc., and also on individual tree species.

The field check may be combined with a certain amount of enumeration work, and it should, in any case, make use of existing enumeration data. Strip enumerations, or the location of sample plots, should be plotted on the preliminary forest type maps or on mosaic, and efforts made to relate vegetation trends noted on the enumeration records to patterns observed on the aerial photographs.

For example, counts of emergent tree crowns on aerial photographs may prove to be related to the density of exploitable tree species on the ground. The aim in this case is to relate crown counts on the aerial photographs to field enumeration records, and then to forecast enumeration results from crown counts over areas which have not been surveyed by enumeration parties in the field. In work undertaken by the writer there were indications that this was a promising line of approach where individual tree species could not be identified on aerial photographs. A high emergent crown count, in unexploited forest areas, was related to a high proportion of merchantable trees and vice versa. The crown counts are carried out under a stereoscope with the aid of transparent templates laid at intervals on a grid marked on the photographs.

Enumeration work in tropical rain forests is difficult and expensive, ranging from about U.S.$1.75 to $2.6 per cubic hectare for 100 percent enumeration of mature merchantable tree species.

Naturally 100 percent enumerations are only carried out in selected areas, but in the rich tropical forest areas known to the writer these 100 percent stock surveys were adopted because a lower percentage sample did not produce the information required. In the first instance 1 percent, 2.5 percent or 5 percent surveys were carried out to give an indication of the value of the forest. Practical and economic considerations usually dictate a low percentage survey but it is emphasized that while this percentage sample may suffice for the purposes of a management plan it is generally insufficient for the forester or logging manager concerned with extraction in these areas. Despite the cost, he much prefers the 100 percent stock survey which shows the location of the individual mature trees of each of the commercially valuable tree species. If such a stock map can also show the topography of the area to be exploited then so much the better, but the cost of preparing such a map by ground methods alone ranges between U.S. $2.2 and $2.7 per hectare.[1] These prices are likely to increase year by year as labor costs rise, and it is obvious that some means of reducing this overall cost is desirable.

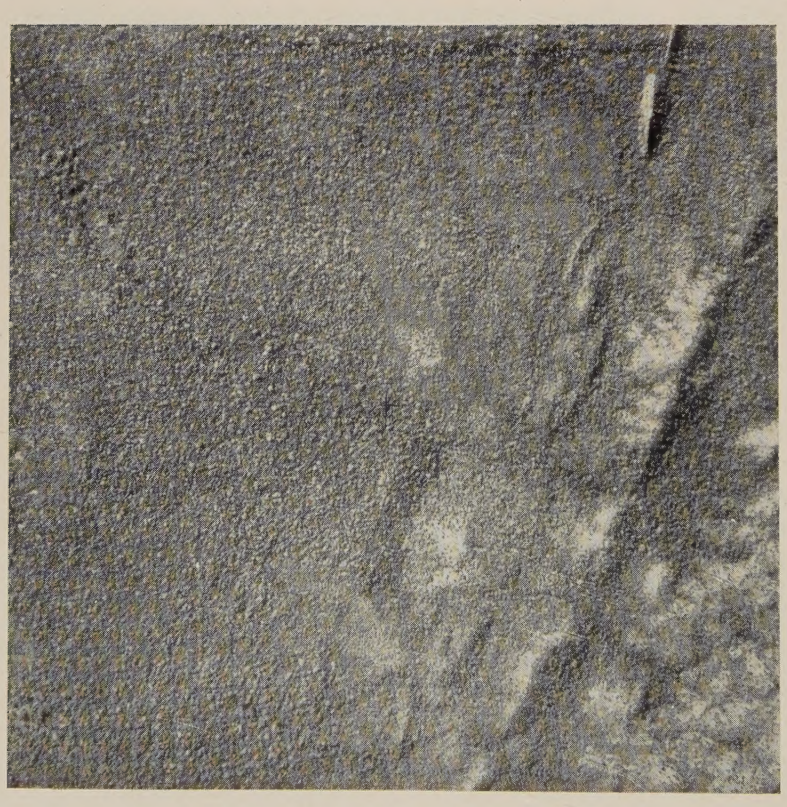
Enumeration work on a more widely spaced grip will reduce the percentage sample and the application of statistical methods to the analysis of enumeration records can result in economies in expensive field work. However, the logging manager concerned with timber extraction

[1] Approximate costs Ghana, 1956.

would at once complain that he would not be getting the detailed stock and topographic map, prepared from an intensive grip survey, which enables him to plan his extraction roads in the most economic manner.

Enumeration work may be expensive but the cost of road construction and maintenance on an unsuitable alignment may be far greater than any savings made at the enumeration stage. This emphasizes the importance of a good alignment for the main haulage roads within a forest area and leads to the question of suitable topographic maps for tropical rain forest areas, which is dealt with in a later section.

FIGURE 5. *A small-scale (1 : 36,000) aerial photograph and an example of preliminary photo-interpretation showing possible stratification of tropical forest into forest types. Compare with Figure 3, where large scale and lack of subdivision into forest types make photo-interpretation more difficult.*



Key

A. *Small light colored crowns, grouped*
?A. *Light colored crowns, possibly 'A', but more scattered*
B. *Light colored feathery textured crowns*
?B. *Younger trees of type 'B'*
C. *Dark close crowns, lower than surrounding forest*
D. *Open forest on steep slopes - ? erosion*
E. *Medium tone, many light-toned large emergents*
F. *Riverine forest, scattered large emergents*
G. *Medium tone, few light-toned emergents*

Final photo-interpretation and compilation of a forest type map

Following the field check, the forester returns to his base with the results in the shape of annotated field mosaic or preliminary forest type map. He now carries out a further photo-interpretation of the prints, marking on this occasion the final forest type boundaries which will be transferred to the base map.

The forest type boundaries marked on the contact prints are transferred to the base map by means of a suitable photogrammetric instrument such as a sketch-master or radial line plotter. A suitable scale for a base map is 1:50,000 though for detailed use many foresters prefer the scale of 1:15,000.

The latter scale, or larger, is required if individual trees of mature dimensions are to be shown on the finished maps. In this connection it should be appreciated that trees over a recognized girth limit (27.5 centimeters in the case of mahogany in Ghana) will be more readily identifiable on the aerial photographs by reason of their larger crowns. The crown diameter/stem diameter relationship has not been fully investigated in the tropical forest areas known to the writer, but there seems to be little doubt that the correlation existing between these factors in temperate tree species applies too to many tropical tree species.

A proved relationship would enable the photo-interpreter using a crown diameter scale to compile a forest stock map showing the mature individuals of identifiable tree species.

Having dealt with the use and limitations of aerial photographs in locating the merchantable timber in tropical forests, its extraction must now be considered.

Compilation of a topographic map in tropical forests

The traditional method of preparing topographic maps in dense tropical forests is that of ground surveys. Traverses and lines of levels are run along existing paths or rivers, and along traces cut through the forest on a grid system. Trace cutting is slow and expensive but until recently there was no alternative to this method.

The new method is to make use of photogrammetric techniques in the preparation of topographic maps. A detailed description of the method used has been published elsewhere,[2] and only brief details will be given here.

Form-lined maps may be prepared from aerial photographs of a tropical forest area through the use of modern photogrammetric machines and a limited amount of ground control. The latter can be eliminated altogether, and satisfactory maps have been produced in this way for a forest area in Ghana, but the provision of a certain amount of ground control is desirable. The form-lining is carried out by photogrammetrists on the forest canopy through a stereoscopic plotting machine. Variations in canopy height will, of course, affect the accuracy of form-lining, but it has been found in practice that the overall accuracy falls well within acceptable standards.

Such maps can be produced more cheaply and far more quickly than maps prepared by ground methods.

Topographic and forest maps

Modern processes which may be used in the final compilation of topographic and forest maps are such that the maps may be printed separately, or together, or one as an overlay to the other. The use of a transparent nondistorting medium for such maps facilitates the production of cheap dye-line copies of the original maps for field use.

Perhaps the most important function of the finished maps to the forester is the planimetric control which they exercise over all area measurement made on them. The area of each forest type can be planimetered and the degree of sampling in the field adjusted either to give a standard percentage sample over the whole area (e.g., 10 percent by area of each forest type) or to increase the intensity of field sampling in the more valuable forest types.

Dry tropical forests

There are certain features about the use of aerial photographs in these areas which call for comment. First among these is the fact that the stratification of the forest into various forest types and vegetation communities is far easier than in mixed tropical rain forests. Secondly, fewer tree species per hectare mean a greater chance of individual tree species identification from aerial photographs.

Against these advantages must be set the relatively low exploitable potential of the forests themselves. It is possible in these forests to produce accurate forest and topographic maps from aerial photographs supplemented by a limited amount of field work, but only rarely can the yield of timber per hectare provide economic justification for the cost of such a survey.

The forester in these areas will usually have to rely on small-scale aerial photographs taken for topographic mapping purposes, e.g., the small-scale photography of many of the British African territories. Useful and accurate forest maps can be prepared from these photographs and areas of denser forest can be provisionally selected for forest reservation.

Enumeration work is less difficult in these forests and field sampling facilitated by the stratification of the forest which is itself simplified by the clearly defined boundaries to the different forest types.

Ecological relationship are more apparent in such areas as vegetation patterns on aerial photographs often indicate changes in the soils and underlying geological formations.

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[2] Mott, P. G. The Contouring of a Tropical Forest Area in Ceylon by the use of Aerial Photographs. *Empire Forestry Review*, March, 1956 and *Photogrammetric Engineering*, June, 1955.

The Establishment of a Board Operation

Major Factors to be Considered

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There are strict limits to the price at which boards find a market, since they merely replace other materials or add dispensable comfort. The use of boards is favored by expensive substitutes, a high standard of living, and a cold climate.

Freight and packing add much to the cost of manufacture; they limit exports and offer a considerable degree of natural protection to any domestic board industry. Customs duties further limit demand to such an extent that a mill which utilizes protection to the full may find no outlet for its production except in large and wealthy countries.

Integration with an industry producing suitable wastes to be used as raw materials is a conspicuous advantage. Since small board mills are penalized by high costs, it would be more profitable to start on a large scale provided that the conditions justified such an enterprise.

Even large mills employ few hands, and the increasing use of boards in building and other industries effects an economy of labor. In other words, a board operation releases more workers than it employs.

Time and money are saved by entrusting the task of projecting, planning and starting up operations to a competent firm of consultants. However, the technical part of the project is the most secure because its details are well known, whereas local conditions always vary. The latter have a decisive influence on the success or failure of a project and are much more difficult to assess. Weighing their relative importance is a hard task for anybody and well-nigh impossible for potential investors lacking previous experience in board production.

Numerous advantages are obtained if prospective manufacturers in undeveloped markets join hands with a manufacturer in a leading board producing country. His co-operation can be secured only if solid facts indicate that his experts and capital may expect fair treatment in the country concerned.

Major Factors Influencing the Use of Boards

Selling price of boards

Probably no other factor has a more decisive influence on consumption than selling price. In an undeveloped market a reduction in price can multiply the use of boards; in a large market an increase in price can considerably reduce it. The simple explanation is that substitutes for boards exist, namely, those materials which were used before boards were introduced.

Apart from low manufacturing costs, the following factors exert a substantial influence on the selling price of boards:

(a) *Inland transport.* Since boards are bulky, adequate means of transport to ensure country-wide distribution are a prerequisite for their maximum utilization.

(b) *Cost of freight, insurance and packing for export.* If boards are to reach a foreign market, costs of freight, insurance and packing are an important item. In the following Table these costs are expressed as a percentage of "normal" manufacturing costs:

Table 1. - Costs of Freight Expressed as a Percentage of "Normal Manufacturing Costs"

Type of board	Distance	Route	Packing	Percent
Hardboard	Near overseas	Sea	Little or none	25
,,	Far overseas	Sea	Solid	80
Particle board	Up to 1,000 km.	Rail	None	25

Selling price of substitutes

If the prices of substitutes (mainly sawn lumber, plywood and blockboards) are low and the supply of these materials is abundant, the market for boards may very well be small. In countries where furniture is made from solid timber and no veneer industry exists there would be no market for particle boards as furniture cores. On the other hand, this market is increasing steadily in those countries where solid timber is scarce and expensive, and where consumers are prepared to pay for high-class furniture made with particle board as a base.

Handling, cutting to size and fabricating

Boards are easier to handle, to cut to size and to fabricate than any alternative material. This means an economy of labor on building sites, in carpentry shops and in door and furniture factories. High wage level increases the monetary value of these facilities.

Their ease of handling renders boards highly suitable for amateur carpentry. It is difficult to estimate the percentage of total board consumption that such jobs represent, but manufacturers agree that it is significant.

New uses for boards

The properties of boards have been found to be more diverse than those of the materials that they were originally intended to replace. New uses for boards have been discovered as users have become increasingly "board-minded", and manufacturers, in their turn, have been stimulated to make special qualities for such purposes. This interaction between production and consumption appears to be a slow but continuous process. It is accentuated wherever high purchasing power has permitted consumers to become more and more selective as regards quality and comfort.

High standards of living

A large floor surface in every home favors the use of all kinds of boards for doors, fittings, cupboards and furniture, in addition to actual house construction.

Cold climate

Low external temperatures encourage the use of insulation boards as a means of heat retention, and of hardboards for keeping out drafts, while particle boards are to be recommended since both dampness and the dryness resulting from central heating play havoc with furniture made from solid timber and have an extremely deleterious effect on block boards.

As mentioned above, the use of boards is favored in countries with a high standard of living, a cold climate, and highly developed forest industries and means of transport. But countries in which one or more of these conditions are absent might still be able to produce boards at an equally low — or even lower — manufacturing cost. Normally, a well-equipped and well-managed full-size mill in any country should be able to undercut the price of imported boards by at least 20 percent. Examples of a 40 percent cut — and more — are known. This in itself does not, however, justify the establishment of a board operation. A suitable market must be found. If the boards are to be exported, packing, freight and insurance costs, as well as customs duties, are an important consideration. Those countries which can maintain their export markets have either a solidly established home market or exceptionally low manufacturing costs; usually they have both.

Production of Boards

Basic raw materials

The safest and cheapest source of raw material is abundant mill waste which has previously been used only as fuel or which may even have cost money to dispose of. Some examples are the waste in big sawmills and in plywood factories; chestnut, wattle or oak; chips remaining after the extraction of tanning, and flax shives (for particle board). Other waste, such as bagasse, reeds and straw may turn out quite expensive before being available for processing in a board mill.

Once started, a board industry may soon outgrow the availability of mill waste and have to add forest waste from other species or from better grades of timber. The demand for better quality boards may lead to the replacing of waste by roundwood. This has happened in the manufacture of particle boards for furniture core. Technical progress, however, tends to make it possible to revert roundwood, a material which might have more profitable uses.

Abundance of waste is the best stimulus for starting a board operation. The more substantial the fraction of cheap waste the better is the guarantee of low manufacturing costs and the less likely is the individual manufacturer to be the first victim of an economic crisis.

It is an error to assume that the present prices of raw materials available in the neighborhood of the projected site will remain unchanged when the mill is in operation. The price of the raw material may increase considerably if the mill's requirements represent a substantial fraction of availabilities. In practice, part of these requirements may have to be brought over long distances at high cost, or it may even be necessary to replace the raw material hitherto in use by a different commodity. Such a development is an indication that the mill has been wrongly located, a not uncommon occurrence.

Water

A sustained and adequate supply of sweet water, even in the driest years, is necessary for the manufacture of hardboard and insulation board. The disposal of the effluent might create difficulties. If, as is generally the case, official authorization is required to use the water and to dispose of the effluent, any contravention of regulations can be very costly. Consultants should be engaged to analyse the water and to advise on methods of purification.

Size of mill

Most investors would prefer to start on a small scale and to finance extensions out of profits. However, what may be considered as the economically smallest, respectively optimum capacity has been increasing ever since the manufacture of boards started and is now rather considerable. The following Table gives an idea of this trend.

In the leading board producing countries economically optimum capacities per factory may be twice as high or more. Local conditions such as size of market, raw materials available, level of wages and possibilities of integration can make smaller units remunerative. This is particularly true in the case of captive plants, for example a particle board plant owned by and inte-

grated with a furniture factory sufficiently large to absorb all or a substantial part of the boards produced. Mills making hardboard or insulation board must work 24 hours per day, but particle board plants can operate only 16 hours per day without being heavily penalized in manufacturing costs.

TABLE 2. - OPTIMUM CAPACITY OF MILL

Type of board	Tons per hour	
	Some years ago	Today
Hardboard	3.0	3.7
Insulation board	1.5	2.5
Particle board	1.0	1.5

The capital required for a mill with 50 percent of the capacity indicated in the above Table usually averages 75 percent of the capital required for a full-size operation but the smaller mill generally has manufacturing costs which may be higher by some 25 percent. Integration of a small mill with an existing industry, or other favorable circumstances, might result in seemingly reasonable manufacturing costs, but if the potential demand for boards and the availability of raw materials justify a full-size mill, the risk of starting on a small scale is that sooner or later a competitor will build a bigger mill and produce at lower cost.

Therefore, lack of capital should not be allowed to reduce the capacity of a new plant below what would have been the most economical unit if enough capital had been available. If potential demand does not justify a full-size mill, second thoughts should be given to the establishment of a board operation.

Site of mill

The selection of site depends on the location of the principal raw material, means of transport, and distance to centers of consumption, possibilities of integration with other industries, availability of labor, housing, suitability and cost of land — to mention only the most important factors. The factory compound should be extensive enough to provide for expansion to at least twice the original size. There should be adequate accommodation for stocks of raw materials. If the purchase season is short, this storage space represents a considerable part of the factory compound.

OTHER MAJOR FACTORS

Marketing possibilities

Many investors seem to be more willing to stake large sums on a new plant than a small sum on examining if such a plant is justified. However, a new factory's chances of success can be fairly well ascertained if a couple of percent of the capital required for a new mill are spent on market survey and market research. The approach to this investigation will differ according to the stage of development of the market.

1. In a country with a well-established market the potential investors can concentrate their investigation on determining their competitive power. The main elements of the costs of production and sales can be fairly accurately estimated for the weaker competitors as well as for the new mill. It is no secret to anyone if a competitor's mill is unfavorably located from the points of view of supply of raw material, power or fuel, in relation to markets, or if the equipment has become old-fashioned. That the new mill will have higher costs of depreciation than the competitors need not alarm potential investors, because these costs will take care of themselves under normal conditions.

The cost of inland freight, commission, discount, rebates, salaries and overheads for salesmen, sales office staff and publicity can also be estimated fairly accurately. It is not so easy to assess the percentage of lower quality boards, the proportion of which may be fairly high in the early days of production. Nor is it easy to estimate the odd dimensions which remain after cutting to size in compliance with customers' orders. Heavy rebates may be necessary to get rid of such stocks, especially if they are allowed to accumulate. The real loss resulting from these factors varies from enterprise to enterprise, depending on the sales and the manufacturing standards.

In one instance, where these factors were overlooked in an estimate, the actual break-even point was found to be $^2/_3$ of capacity instead of the $^1/_3$ that had been estimated. Profit was some 60 percent lower than expected, and loss would have resulted had not the estimate of profit been exceptionally high in the first place, and otherwise correctly computed.

It seems to be common practice to base estimates of costs and profits on the possibility always to utilize the mill's capacity to the full. The real average over a number of years may differ in different countries but will hardly exceed 250 working days per annum in any free market.

2. In a country to which either hardboards, insulation boards or particle boards are imported in quantities representing say $^1/_3$ or more of the capacity of a full-size mill, demand will increase if a new mill can sell at the f.o.b. price of the imported boards. In this case, the establishment of a full-size mill for making the kind of board most in demand would be justified, but the estimates of manufacturing costs plus ample marketing costs must be reliable. If investors are hesitant, a thorough investigation of the market should be made before it is decided to establish a small-scale operation. Such a mill would always be burdened with high manufacturing costs, and to double capacity would call for an outlay of capital which would be disproportionate to the increase in production.

3. In areas where there is little or no market for boards, a solid piece of market research is called for. Experts in this field should be of help. The following

is one line of approach. Estimate the lowest profitable selling price of board manufactured within the country. Compare that price with the selling price of the goods which the board would replace. Assess to what extent it can replace these goods. A check on that estimate and some indication of potential demand for new uses might be obtained by importing fair quantities of board.

Degree of rationalization

Authorities in countries with unemployment would no doubt wish to see many hands occupied in a new board operation. However, from the point where the raw material enters the mill to the point where the finished boards leave it, it is hardly possible to employ more than the very few hands which are normally required.

The high degree of automation reached in the manufacturing processes of all kinds of boards has been sponsored not only by a natural trend in highly developed countries towards reduced labor costs, but also by the desire to avoid waste and to maintain a consistently high standard.

In a country where wages are low it may be justified to rationalize handling in the factory yard and workshops to a lesser degree than is now usual in the leading board-producing countries. Investors in a new mill will have to estimate the precise degree of mechanization of handling which is required in their mill.

Employment

Very few hands are employed in a board operation; and many more workers become redundant with the increasing use of boards in building and other industries. Since the manufacture of substitutes is less rationalized than that of boards, an economy of labor is also effected by the reduction in the use of substitutes provoked by the introduction of boards. In other words, the board industry sets more hands free than it in fact employs. This has always been one of the chief justifications for setting up the industry. To plead the contrary for obtaining authorization to establish a board operation would be a gross misrepresentation of the facts. Besides, in order to reduce unemployment, no country can afford to spend from U.S. $10,000 to $40,000 per capita employed.

Customs duties

The value of fostering an infant industry by the imposition of customs tariffs on the imported article is largely dependent on whether or not substitutes exist for the goods thus protected.

In countries where salaries and wages are low, consumers are sometimes forced to pay 3 or 4 times more for paper than the price paid in the leading paper-producing countries, where salaries may be 3 or 4 times higher. The consumption of paper per capita in the latter countries will probably be a hundred times greater, but if the former countries cannot afford foreign exchange for paper purchases, a domestic industry might be protected to the point where its production would help to reduce illiteracy and be of some use in the packing of goods for distribution.

This is not the case with boards, however, simply because substitutes do exist, i.e., those materials which have been used hitherto. Owing to the very high natural protection offered by packing and freight charges, even seemingly reasonable customs duties easily bring the selling price of boards in importing countries up to twice the price paid in the leading board-producing countries. Such a high price level would substantially reduce the demand in any country; it will certainly do so in those countries with low purchasing power or where cheap substitutes are available. The apparent lack of potential demand will frighten investors or induce them to establish a small, inefficiently managed mill requiring still more protection.

When substitutes for boards are scarce and expensive, the levying of customs duties on imports can facilitate the establishment of a board mill, but the boards will be expensive and the estimate of potential demand at the resulting high selling price must be made with the utmost care.

Customs duties are of course useful as an ultimate weapon against persistent dumping.

Capital requirements

Consultants' estimates comprise expenditure on factory buildings and equipment, their own fee, and usually also the cost of administration, salaries and interest on capital during erection. To this total, potential investors must add the cost of land, of layout, and of office facilities, as well as expenditure on equipment for transporting raw materials to the factory and distributing the finished goods; automobiles; the cost of preparing the project; local consultants' fees; legal costs, and, depending on local conditions, perhaps many other items. If the board mill is not integrated with an existing industry and has to be located in a remote district, additional capital may be required for roads, railway sidings or quays; a power station; a more than usually well-equipped repair shop; houses with running water, drainage and light, at least for the senior staff if not for all personnel. In adverse circumstances, even more facilities may have to be provided.

Contingencies are usually estimated at 10 percent of the cost of equipment. This may cover extras when the purchasing power of money remains stable, but as long as prices continue to rise at the rate that has prevailed during the post-war era, it would be advisable to estimate contingencies at 20 percent of total fixed capital.

Since working capital varies from country to country and from industry to industry, an estimate based on rules of thumb would be extremely unreliable. It is in fact equally rapid to estimate working capital item by item; annual maximum and minimum stocks of raw

material; annual maximum and minimum stocks of boards, if demand is seasonal; annual maximum and minimum stocks of spare parts, as indicated by the consulting firm, due regard being given to possible delays in delivery from supplier countries.

Influence on the balance of trade

In most countries, the establishment of a board operation is subject to government approval. The authorities concerned often demand a detailed justification of the venture, expressed in terms of money. They nearly always require some indication as to the amount of foreign exchange needed for equipment purchases, as well as information on the chances of saving foreign exchange on imports and of export returns. The latter point is extremely difficult to estimate. A newcomer cannot even correctly estimate the cost of packing and marketing expenses abroad, and it takes a great deal of intimate knowledge both of the marketing and production of boards to be able to judge what margin competitors have for fighting a newcomer. Unless the new mill has exceptionally low manufacturing costs, it would be as well to estimate the probable proceeds from exports and then divide by ten.

Interrelation of factors

If a board operation is to be financially sound and economically justifiable, the interdependence of certain factors must be taken into account. For example, the type of board to be manufactured must be determined by marketability and the kind of raw material available. Similarly, the choice of process is intimately linked with the raw material selected, and the size and site of mill with the type of board to be manufactured, its market prospects, and raw material availabilities. Capital requirements, manufacturing costs and profitability will depend, in their turn, on all the foregoing factors. In brief, it is the sum total of these factors which determines whether or not the venture is a sound business proposition. Thus, all-round planning cannot be dispensed with.

Projecting, Planning and Starting a Board Operation

Projecting

The cost of establishing a complete project is considerable. It is useless to attack the blue-print stage and to give the project its finishing touches unless preliminary investigations indicate that the venture can be considered sound and the necessary capital can be mobilized. Given the interdependence of all factors, the best approach is to prepare a very preliminary but complete project and find out if and how the most glaring difficulties it reveals can be solved. If the venture then looks promising, a more complete project is established. If such an approach is adopted, an unsound project can be written off quickly, while a sound one can be established with the minimum of effort, time and money. In this respect, contact with a competent consultant from the very beginning will be of immense help.

Planning and starting operations

Progress is so rapid and the responsibility to be borne by the prospective manufacturer is so heavy and complicated that even well-established board manufacturers prefer to seek expert advice. If a major mistake is made in planning, costly changes in equipment and commercial losses may result. Before the mistake can be remedied the ensuing losses may soon represent a sum which is many times greater than a reasonable consultant's fee.

The consultant's main job is planning and starting operations from the moment raw materials arrive at the mill until boards of good quality leave it. However, this highly technical part of a board operation is the most secure since the problems involved are well understood by competent consulting firms. Other factors, which all vary from mill to mill, are much more difficult to assess, and the penalty of misjudging their influence can be severe.

Partnership with an Established Manufacturer

The following advantages might be gained by those investors who lack experience in board operations but who are willing to go into partnership with an established manufacturer:

1. opportunity to study an existing board operation in detail;
2. help in assessing local conditions, consultants' suggestions, offers from machine suppliers, export opportunities, assistance in weighing up the pros and cons;
3. reduction in the "waiting-for-money" period caused by delays in planning, erection and commencement of operations;
4. facilities for training in an existing mill the personnel intended for key positions in the new mill;
5. competence in running the mill and marketing the boards;
6. an experienced partner, who is willing to share risks, and who is also capable of reducing them;
7. facilities for recruiting from that country experienced men for key positions, if the manufacturer is established in another country, for men are apt to believe that if a countryman of theirs holds a leading position in the firm it is a guarantee of fair treatment and of success for the new company;

8. saving foreign exchange, which would otherwise be required for equipment imports, provided that the manufacturer accepts shares in the new company for the value of such equipment. Even a minority shareholding by the manufacturer will be sufficient, since the total capital required for the establishment of a board operation represents twice the cost of equipment or more.

An established manufacturer will naturally be reluctant to help a newcomer. However, he knows that all new board mills that are economically justifiable will be established sooner or later, whether he likes it or not. If well managed, such new mills should be just as profitable as his own enterprise proved to be when board production forged ahead in his country. He will also quickly discern the new mill's export possibilities.

The securing of his collaboration is, therefore, largely a matter of offering him a fair deal and of winning his confidence in the future of the prospective manufacturer's country, and in assuring him that conditions are favorable for foreigners as regards both employment and the investing of capital.

Financing

An additional source of financial assistance is the International Finance Corporation, Washington, D.C., U.S.A. This organization is supported by a substantial number of governments whose aim is "to further economic development by promoting the spread of private enterprise in the developing areas of the world". They intend to do this by "serving as a clearing house to bring together investment opportunities, private capital, both foreign and domestic, and experienced management". The scope of their activity and their conditions for loans have been well defined.[1] These conditions are so sound that they should be studied by potential investors, whether or not they seek assistance from this body.

[1] See the pamphlet entitled *The International Finance Corporation*, Washington, D.C., 10 August 1956.

The foregoing paper and the paper that follows were contributed to the first world-wide consultation on insulation board, hardboard and particle board which, under the joint sponsorship of FAO and the Economic Commission for Europe, took place at the Palais des Nations in Geneva from 21 January to 4 February. Over 330 participants — technicians, manufacturers, equipment makers, and government specialists from 36 countries — exchanged information and experience on the technical and economic aspects of the industries and found widely different practices and applications in various regions of the world, many of them adaptable to areas where they are not now in use.

The information made available by the consultation will serve, on the one hand, to encourage the expansion of these industries where raw materials, marketing possibilities and estimated production costs warrant such expansion, and on the other hand to discourage ill-advised investment where economic and technical conditions are unfavorable.

The documentation of the meeting is to be published in two volumes. Volume I will contain the secretariat papers and appendices, revised and amplified in the light of the discussions which took place. Volume II will comprise the various background papers.

Production of board products is today highly concentrated geographically, principally in Scandinavia, North America and Western Europe. The Report of the Consultation says that:

1. "A trend towards a more even geographical distribution of these industries in the coming years is inevitable."
2. "It is in the interest of both new and established producing centers that in planning new developments full regard be paid to their economic viability and that account be taken of the best technical knowledge currently available."

The consultation agreed that while the long-term view of these industries is assured and their products are destined to make a growing contribution to rising living standards throughout the world, it is in the interests of all concerned that severe imbalance between production capacity and effective demand should not arise.

Boards and the Utilization of Tropical Forests

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Complete utilization of tropical forests has long been the hope of the forester. Occasionally it is realized in more or less pure stands or in areas with a comparatively few species of which all are of value. More often forests are very mixed and a few preferred species only are exploited. Sometimes where pure stands do occur they are intermingled with areas of mixed species.

Under such conditions of incomplete logging, the logger has to work over a large area to secure the required yield of logs and because extraction lines, roads, etc, are largely affected by area, then cost per unit of timber secured is greatly inflated. In addition, some of the most economical logging equipment is only feasible where extractable volume per acre is high, that is, in reasonably dense stands which are more or less fully logged. The forester is also faced with a problem in mixed forest, of what to do with the remaining trees which may comprise 50 percent or more of the stand and may interfere with regeneration and growth of the preferred species.

Any means of using non-preferred species can therefore be of importance in giving:

(*a*) an all-round reduction in logging costs;

(*b*) an increase of timber supplies;

(*c*) assistance to the forester in growing the next crop.

These non-preferred species may be regarded as inferior simply because they are unknown or because any one species is in too limited a quantity to justify market promotion: they may be susceptible to troubles in the log such as pinhole borer attack and fungal staining, to troubles during sawing from high silica content or tension wood, or to troubles after sawing such as powder post beetle attack. They can vary in density from very low to very high, in color from almost white to almost black and in texture from loose fibrous material to strong close-textured wood.

Practically all these woods can produce one or more of the sheet materials — insulation board, hardboard or particle board — although naturally for any use there will be selected species or groups of species which will give the best results because of density, ease of disintegration, color or some other desirable attribute.

In selecting the type of product and the woods most suitable for it, market conditions must first be explored. Following this, there are then a number of general principles which can be applied, although naturally there can be exceptions to these principles because of special or outstanding circumstances. Light weight and light color can be useful attributes for wood for insulation board. Very brittle woods should be viewed with suspicion because of possible difficulty from excessive fines in pulping. Heavier timbers can be used but may involve a cooking or presteaming treatment. Similarly, dark color can be overcome by coating on the forming machine or by prime coating with paint, but all these add to cost.

Almost any wood can be used for hardboard, which is the least exacting of all boards as far as raw materials are concerned. Any selection would be on obvious lines such as selecting species most easily handled and avoiding if possible those with high extractive content.

For particle board, the light and medium density timbers are most desired. Susceptibility to borer attack (lyctus) is probably not a factor with particle board especially where the particles are small. In any case, in tropical areas antifungal and antitermite provision is usually essential and this can eliminate borer attack.

Apart from characteristics of raw materials, there are other factors to be taken into account such as local traditions of use of similar materials, climatic conditions and problems of water supply and effluent. Difficulties with the last named might influence selection towards dry felting rather than wet felting processes.

If insulation board, hardboard and particle board have not been in use to any extent in the particular country concerned there would be great advantage in importing quantities and trying these out under local conditions. Special problems which cannot otherwise be foreseen can unexpectedly arise and can result in a new plant getting off to a very poor start. In one case, a new insulation board suffered from a strong prejudice because it was very susceptible to damage by rats and mice prevalent in the area. The need for special antifungal treatment and antitermite treatment, as well as the desirable moisture content to which the board should be humidified are some of the factors which might be disclosed.

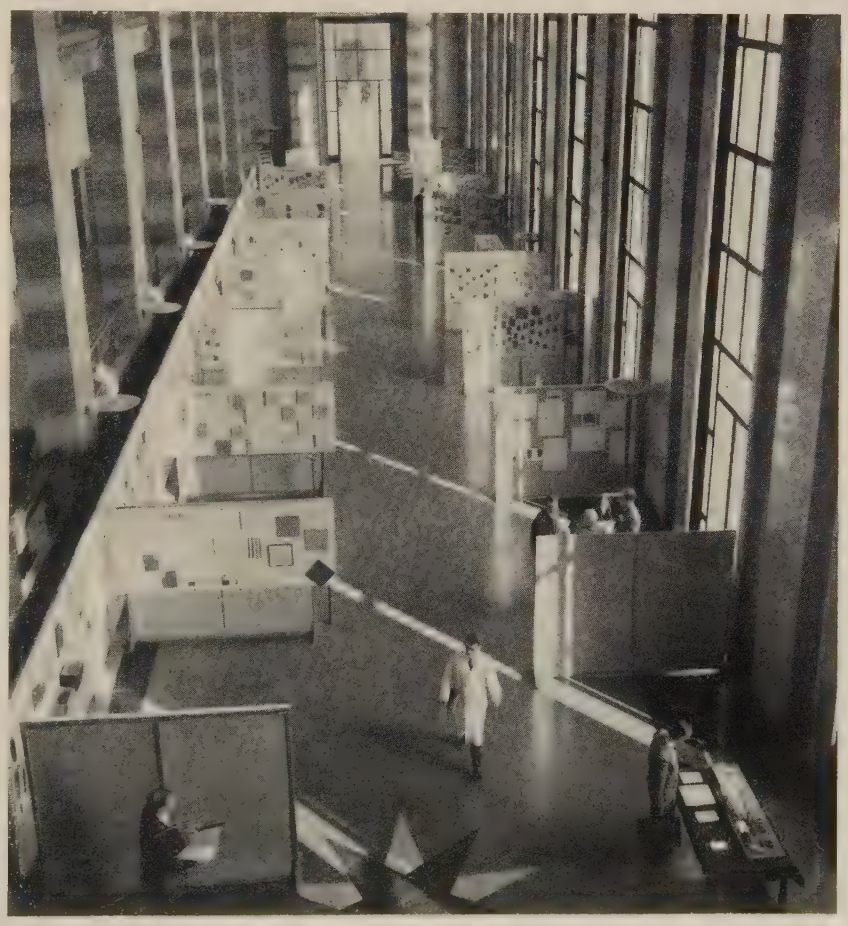
There is a tendency today to set up a laboratory when an industry new to a country is first proposed. In the case of building boards from wood, such a proposal is fraught with difficulties and only in exceptional cases is to be recommended. In the first place, it is not feasible to set up laboratory plant to test out all processes, because some of these require vastly different equipment. Secondly, such experimental equipment can usually only be provided with laboratory size units which do not always

detect the problems likely to be encountered. Thirdly, the most likely types of plant required can be selected from information already available and, once types are fixed, manufacturers of plant have facilities for carrying out experimental work with new materials using staff of long experience and often full-scale equipment. Such manufacturers are then in a position to incorporate in the design of the plant to be supplied, any special features indicated by the results of the experiments.

In the countries where manufacture of fibreboard and particle board is most advanced, it is customary to look for the raw material for these products in the forest and milling residues which are mostly in the form of small or malformed trees, sawmill edgings, dockings, etc. The position is very different in the mixed tropical forests because the non-preferred trees are often of good size and form. It is, therefore, as well to remember that there is another sheet material, plywood which can be made readily from the logs available. Plywood has the advantage that it can be produced in small plants requiring no great skill, operating day time only if desired and producing a range of products from the thinnest three-ply to plyboard of the usual thicknesses of particle board. Attractive figures can often be obtained from many tropical woods either by ordinary rotary cutting or by sawing the log in half and dogging it so that it swings on an axis near the outer sapwood. This range of products and the small capacity can be of great importance in underdeveloped countries where transport is often a problem particularly at certain seasons of the year.

Modern development in log sanitation from stump to plant and in simple and cheap dip-diffusion treatments of veneer to prevent borer, termite and decay attack have revolutionized the future of the once unwanted species. For example, in a part of Borneo before the war, the major expenditure in forest stand improvement was for poisoning ramin (*Gonystylus* spp.) so that other species could be encouraged. Today, ramin is the major export species, and logs are shipped to Australia and elsewhere, peeled, treated and made into plywood which is well-esteemed. Forest practices have been worked out to reduce pinhole borer attack and staining to negligible proportions and the treated veneer is absolutely immune to powder post beetle attack.

It would be idle to assume that in all these sheet materials there is the solution to the problem of the complete exploitation of tropical forests. The controlling factor must be the markets available and, until they are greatly expanded, the contribution which boards can make towards overall tropical forest utilization will be small. However, there will be many places where an active and growing demand can be built up and here the logger and the forester will have an added incentive towards fuller utilization of mixed tropical forests.



An important feature of the consultation on insulation board, hardboard and particle board held this year in Geneva and sponsored by FAO and ECE was the organization of an exhibition to show the latest developments of these industries. Over 1,000 specimens of boards and raw materials were contributed by commercial concerns and technical institutes and the display included eight small-scale models of plants and a large number of photographs and charts, to illustrate different types of equipment and processes of manufacture.

An Accounting System for Mechanical and Motorized Equipment

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Rapid strides have been made in recent years in the development and improvement of mechanical and motorized equipment, and industry has quickly seized the opportunity of putting to use such equipment as appeared to be advantageous. The application of mechanical and motorized equipment to industry has made necessary the development of an accurate cost accounting system, which will provide management with the pertinent information required for the exercise of adequate cost control. This need is based on the theory that the ultimate aim of cost accounting is not merely to determine the cost of producing the end product, but also to determine as accurately as possible, the cost of each and every item entering into the final cost. The knowledge of what it costs to produce the end product without using that knowledge to reduce or control production costs not only deprives a cost system of its main purpose — cost control and cost reduction — but leaves little, if any, justification for its existence.

The system described here was designed to provide management with information to exercise such cost control.

Recognition is given to the fact that operating costs of any nature, including accounting, must be kept to a minimum; therefore, absolute accuracy is sacrificed in some cases in the interest of economy. However, accuracy to a practical degree is a necessity in keeping with the principle that the best system of cost accounting is that which gives the most accurate results with the least clerical work.

The first and most important point to be recognized is that the success or failure of any accounting system is the degree to which management is prepared to accept their responsibilities by providing the wherewithal to form the required organization, secure qualified personnel and by supporting the policies and procedures established in connection therewith.

It is assumed that, for the purpose of this paper, the system has the support of management and that the business is not of sufficient size to warrant any major changes in the organization as regards accounting records and personnel. It is also assumed that only a few items of equipment are involved and that it is concentrated in one location, thereby eliminating to a great extent the necessity of general ledger control accounts and auxiliary ledgers.

General ledger

The property, operating cost and income accounts may be set up in the general ledger as follows:

Mechanical and motorized equipment. Separate accounts may be opened to cover each piece of equipment, but it is suggested that one account be all-inclusive to serve as a control account supported by equipment records, which will be discussed below. It is to be debited with the cost value of equipment purchased and credited with depreciation, sales, trade-in allowances, etc. Depreciation is to be set up on the basis of general accounting practice without regard to the relationship it has to actual operating cost. The end profit or loss, with respect to each item of equipment developing through sales, trade-ins, etc., is to be adjusted to equipment operating costs.

Equipment operating cost. Separate accounts are recommended to cover the operating costs of each individual piece of equipment. Ledger sheets are to be designed so as to provide sufficient columns to record each cost classification. It is to be debited with all operating cost items originating through payrolls, stores and other charges, such as licenses, garage accounts, insurance, depreciation and etc. It is closed, in conjunction with the corresponding income account, to a general overhead account when closing the books.

Equipment income account. Separate accounts appear desirable (at least, for this purpose) to cover the earned income accruing through the application of a tariff or fixed rate to the operating medium developed from auxiliary records. It is closed, in conjunction with the corresponding operating cost account, to a general overhead account when closing the books.

The tariff or fixed rate is established on the basis of estimated costs per mile or hour depending upon the nature of the equipment involved and costs desired. Rates are established as follows:

Estimated Costs per Hour

		$
Fuel		0.90
Lubrificating oils and greases		0.05
Tires		0.20
Repairs		0.65
Accessories		0.02
Registration	($ 150. × 1,500 hours)	0.10
Insurance	($ 75. × 1,500 hours)	0.05
Write-off	($4,500. × 4,500 hours)	1.00
Total		2.97

The above estimate was developed on a machine assumed to cost $5,000 with a salvage value of $500. The annual operating time is estimated at 1,500 hours and the life expectancy at 4,500 hours. Rates are established in a similar manner in connection with all mechanical and motorized equipment.

Equipment record

It is assumed that the suggestion concerning the account, mechanical and motorized equipment, has been adopted and that equipment records are necessary. The "button and string" type of envelope is recommended for this purpose primarily because it provides a pocket in which to insert any pertinent information concerning the machine, such as, copy of the purchase invoice, operating cost records, etc. The face of the envelope, or record, showing the information to be recorded thereon, is illustrated in Figure 1.

EQUIPMENT RECORD

LOCATION — **Group Classification**
Local Number

NAME AND DESCRIPTION

ACCESSORIES, IF ANY

SERIAL NUMBER — **MOTOR NUMBER**

DATE OF ACQUISITION — **CAPACITY**

Valuation Account

Date	Reference	Debit	Credit	Balance

FIGURE 1

The first step is to wind up the present records covering existing equipment and transfer the information to the new form of equipment records. It may be necessary to have a physical inventory taken, particularly if the past records are incomplete and unreliable. Thereafter, it is a simple matter to record the required information as new equipment is acquired.

Manufacturers' descriptions, particularly serial numbers, are often confusing as well as lengthy and cumbersome, therefore a system of local identification symbols is a necessity. A combination of letters and figures would appear the best answer for this purpose, using letters to designate a certain group of equipment and serial numbers to identify the machines within that group. For example, automobiles are to be considered as one group and assigned the letter *A*. The first vehicle in that group is assigned number *1*, the second number *2* and so forth. Therefore, the first automobile will be identified by the symbol *A-1*. Such symbols are to be painted, stencilled or otherwise affixed to the machine in a prominent place. Such a system not only provides prompt identification but also facilitates the work involved in keeping the records. It also lessens to some degree the margin of error in charging and distributing cost items.

Location may or may not be a problem depending upon the size and nature of the business. It can be a problem if equipment is assigned to different jobs at more than one location and transfers are common between locations. Such a record must, of necessity, be flexible under these conditions because transfers preclude the assignment of a permanent record of location. The problem can be resolved by including a slot with a cellophane or similar transparent cover in which to insert the proper tabs as transfers are effected.

The other information required appears self-explanatory and, in most cases, may be transcribed direct from the purchase invoice.

This record provides a description, identification, location and a detailed account from which the trial balance can be prepared at the end of an accounting period; also a complete and up-to-date history of the machine and its performance for ready reference. The fact that the information is complete and all inclusive on one record must be considered most important.

Stores and payroll records

It is assumed that the stores and payroll records and accounting will follow the normal routine under the supervision of the accounting department rather than a separate section within the department.

Equipment log book

The equipment log book is used by the operator to record daily such data as the nature of the work performed, unusual working conditions, irregularities noted in connection with machine performance, replenishment of fuel or oil, preventive maintenance including greasing and oiling, replacement of parts or accessories, nature of repairs and any other information of a pertinent nature concerning machine operation and performance. Serial numbers or other similar information is required in connection with the replacement of accessories or parts, such as tires, batteries, etc. It is a permanent record to accompany the machine during its operating life. It is of particular value in connection with mechanical supervision because it can be readily and easily determined if the machine is receiving proper care through preventive maintenance including servicing at regular intervals. It is also effective in drawing the attention of the operator to the fact that his responsibilities include not only the operation of the machine but also maintenance and repairs.

Operator's daily report

The operator's daily report, as shown in Figure 2, is used by the operator to record the details of work performance and operating time. It is completed in duplicate and the original made available to the accounting department at the end of each accounting period.

OPERATORS' DAILY REPORT
MECHANICAL AND MOTORIZED EQUIPMENT

LOCATION ..... **DATE** .....

EQUIPMENT NAME ..... **NUMBER** .....

Nature of Work	Mileage	Machine Hours	Weight Volume	Operator's Hours
Totals				

Other details including explanation of lost time:

Signature

FIGURE 2

The duplicate copy is retained until information is available to indicate that the details meet with the requirements of the accounting department and that no further explanations are necessary.

The report is used in the preparation of the equipment time and cost distribution form for developing equipment operating costs.

A very important consideration is the necessity of impressing the operator with the importance of recording simple and accurate information in order that the resulting operating performance and cost data will be reliable.

Particulars concerning the completion of the report are as follows:

1. The same report form is to be used for all types of equipment.
2. The machine hours and/or mileage is to be recorded in the proper columns.
3. The pay load is to be recorded in the columns weight/volume and expressed in terms of weight or volume in accordance with the cost information desired. Obviously this column is not to be used in connection with many or most items of mechanical equipment.
4. A brief but concise description of work performed is to be recorded in the column headed, Type of Work. The eventual cost distribution originates from this source, therefore, it is essential that the work is accurately described in order to assure a proper cost classification.
5. Speedometer readings, when available, are desirable. It is essential that it be recorded for all vehicles on which unit costs are developed on a mileage basis.
6. An explanation covering lost time while on an assignment is essential. It is not intended to cover lost time between assignments.

Equipment time and cost distribution

Equipment time and cost distribution, see Figure 3, is to be completed from the operators' daily report. The proper charge to the respective cost accounts is developed through calculating the total working time by the tariff or fixed rate. It provides the basis for the accounting entry and the information concerning the operating mileage/hours noted on the equipment operating cost record.

EQUIPMENT TIME AND COST DISTRIBUTION

EQUIPMENT AND NUMBER ..... **PERIOD** .....

Date	Total Miles Hours	Distribution of Miles - Hours											
1													
2													
3													
4													
5													
6													
30													
31													
Total													
Fixed rate													
Amount													

Signature

FIGURE 3

Equipment operating cost record

Equipment operating cost record, see Figure 4, is completed at the end of each accounting period and filed with the equipment record. The operating costs are posted from the ledger account and operating medium from the equipment time and cost distribution. Unit costs are calculated on each individual cost item for the period to date only. The estimated unit costs developed in connection with establishing the tariff or fixed rates are to be recorded in the column provided for that purpose.

EQUIPMENT OPERATING COST RECORD

EQUIPMENT AND NUMBER _____ **PERIOD** _____

Classification	Operating Costs: Current Period	Total To-date	Unit Cost To-date	Estimated Unit Cost (Fixed Rate)
Gasoline				
Fuel oil				
Lub. oil and grease				
Tires				
Repairs				
Accessories				
Registration				
Insurance				
Write-off				
Miscellaneous				
Totals				

Previous operating mileage/hours
Current operating mileage/hours
Total operating mileage/hours

REMARKS :

Signature

FIGURE 4

Summary of equipment operating costs

The summary of equipment operating costs, see Figure 5, is to be prepared from the individual operating cost records and distributed to management. A separate report is required to cover each group classification in order to provide a ready comparison of operating costs by units in that classification.

Equipment appraisal

The equipment appraisal form, see Figure 6, is developed from cost and performance records covering past service and estimates by qualified personnel concerning

SUMMARY OF EQUIPMENT OPERATING COSTS

GROUP CLASSIFICATION _____ **PERIOD** _____

Machine Number	Operating Time	Unit Costs To-date: Gasoline	Fuel Oil	Oil & Grease	Tires	Repairs	Accessories	Registration	Insurance	Write-off	Misc.	Totals

REMARKS

Signature

FIGURE 5

EQUIPMENT APPRAISAL

MACHINE Tractor **DATE** Nov. 22, 1955
NUMBER D-1 **YEAR PURCHASED** 1952
ORIGINAL COST $12,000 **REPLACEMENT COST** $12,000

Item	Total Cost		Cost per Hour or Mile
1. PRESENT COST (EXCLUSIVE OF OIL, GAS AND SERVICE)			
	$	$	$
1. Hours or miles used	8,900		
2. Price of new machine	12,000		
3. Estimated present sale value	2,000		
4. Replacement cos t (Items 2 minus 3)		10,000	
5. Repair cost to date	19,000		
6. Lost time	—		
7. Repairs plus lost time		19,000	
8. Total upkeep cost		29,000	3.26
2. ESTIMATED FUTURE COST			
9. Hours or miles used to date	8,900		
10. Estimated additional life in miles or hours, if overhauled	3,100		
11. Total expected life	12,000		
12. Repairs and lost time to date - Item 7		19,000	
13. Estimated cost of overhaul		5,000	
14. Estimated cost of repairs to next overhaul		6,000	
15. Estimated lost time for same period			
16. Estimated future price for machine	12,000		
17. Estimated sale value at end of expected life	1,000		
18. Estimated replacement cost (item 16 minus 17)		11,000	
19. Expected total upkeep cost		41,000	3.42

NOTE : If item 19 cost per hour exceeds item 8 cost per hour, it would be cheaper to sell than to overhaul and vice versa.

FIGURE 6

future life expectancy. This information is of particular value when arriving at a decision concerning replacement, etc. However, it must be borne in mind that the value of the information is dependent upon the degree of care exercised in developing the estimates. Any estimate which is developed with the view of producing a desired result nullifies the appraisal. It is a difficult situation to control and must be carefully weighed in conjunction with the personnel involved.

A hypothetical appraisal is reproduced in order to simplify the following comments in connection therewith. The example is developed on the basis of a tractor purchased in 1952 at a cost of $12,000. Replacement cost, present and future, is estimated at the same amount, although it would almost certainly not hold true under actual experience.

Records indicate that the cost of fuel, oil and servicing, including minor adjustments, does not increase to any appreciable extent as the use of the machine increases, so that it is not necessary to take these cost items into consideration in determining time for replacement. On the other hand, they indicate that the cost of repairs per hour or mile do increase with the use of the machine. The cost to the operation of lost time due to repairs is a factor which varies under different circumstances and is not given consideration in this appraisal.

Section 1 covering the present cost does not present any particular problem because, with the exception of items two and three, the information is developed from the equipment operating cost record. Items 2 and 3 are estimates based on available information concerning current prices and trade-in allowances.

Section 2 covering the estimated future cost includes the present costs and estimates to cover the additional life, cost of overhaul and normal repairs necessary to keep the machine in operation during that period. It also provides for an adjusted trade-in value at that time.

The increase in the expected total upkeep cost per hour of 16 cents represents a cost penalty of $1,920 if the machine is overhauled and kept in service; thus it provides reasonable assurance that a replacement is in order.

Analysis and interpretation

It should now be assumed that the system described herein has been in effect during a full accounting period and that the accounts and records provided the following information:

Trial Balance - Operating Costs

Item	$
B-1	4,455
B-2	4,905
B-3	3,741
B-4	3,345
TOTAL	16,446

Trial Balance - Income Accounts

Item	$
B-1	4,455
B-2	4,455
B-3	3,564
B-4	2,970
TOTAL	15,444

Equipment Operating Costs

	Item B-1	*Item B-2*	*Item B-3*	*Item B-4*
	$	$	$	$
Fuel	1,350	1,350	1,080	900
Lubricating Oil & Grease	75	75	60	50
Tires	300	450	240	150
Repairs	975	1,275	600	500
Accessories	30	—	12	20
Registration	150	150	150	150
Insurance	75	75	75	75
Write-off	1,500	1,500	1,500	1,500
Miscellaneous	—	30	24	—
TOTALS	4,455	4,905	3,741	3,345

Operating Costs per Hour

	Item B-1	*Item B-2*	*Item B-3*	*Item B-4*
	$	$	$	$
Fuel	0.90	0.90	0.90	0.90
Lubricating Oil & Grease	0.05	0.05	0.05	0.05
Tires	0.20	0.30	0.20	0.15
Repairs	0.65	0.85	0.50	0.50
Accessories	0.02	—	0.01	0.02
Registration	0.10	0.10	0.12	0.15
Insurance	0.05	0.05	0.07	0.08
Write-off	1.00	1.00	1.25	1.50
Miscellaneous	—	0.02	0.02	—
TOTALS	2.97	3.27	3.12	3.35

The ledger accounts (general or subsidiary) provide the information concerning the operating costs and income accounts, whereas the details of the operating costs and unit costs per hour may be developed from the equipment operating cost record and the summary of equipment operating costs. It is to be noted that reconciliations are necessary because the forms are not designed to reflect the details over any particular accounting period.

The income accounts are developed on the basis of the tariff or fixed rate of $2.97 calculated on the following operating time.

Item	*Hours*
B-1	1,500
B-2	1,500
B-3	1,200
B-4	1,000

Registration, insurance and write-off are of a fixed nature and remain constant regardless of operating time involved. The write-off was dictated by the general accounting policy which, in this instance, was over a period of three years.

The undistributed balance in connection with these particular items of equipment is $1,002, and is absorbed in costs as an item of overhead.

The operating cost and income account in connection with item B-1 are developed to illustrate the optimum, which is exact agreement. Such a condition occurs only when actual operating time and costs are identical with the estimates.

The undistributed balance in connection with item B-2 reflects an operating loss of $450, which is accounted for by excess tire and repair costs. A review of the operating records would very likely indicate one of the following three reasons:

a) inferior or faulty item of equipment;

b) unusual operating conditions;

c) inefficient operator.

The important point is that it provides management with reasonably sound facts to take corrective steps.

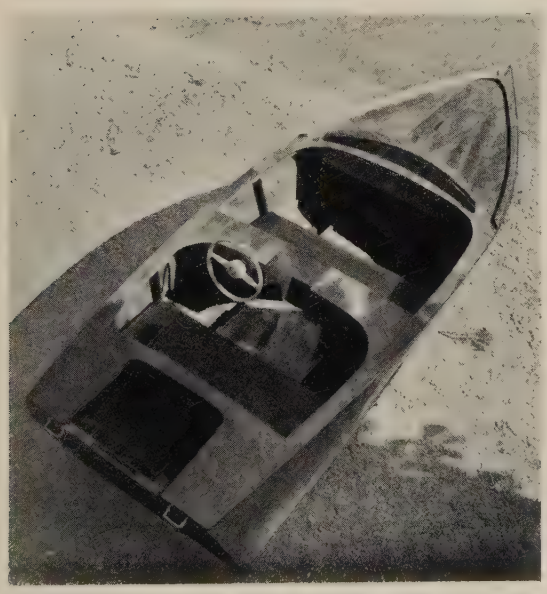
The undistributed balance in connection with item B-3 reflects an operating loss of $177, despite the fact that repair costs were considerably less than provided in the operating cost estimate. The chances are that this situation is temporary and that the repairs will show a sharp increase within the near future. The other item of costs to reflect a substantial variation is the write-off. The examination reveals that, in view of the normal accounting procedure concerning write-off, the operating costs of this particular item of equipment includes a cost penalty because there was not sufficient work available to meet the normal operating time. The same situation is also true with respect to other items of fixed charges, i.e., insurance and registration.

The undistributed balance in connection with item B-4 reflects an operating loss of $375. The same situation exists here as in connection with item B-3, except that the excess unit costs in connection with fixed charges are even more pronounced because of less actual operating time. It is possible that an examination of the records covering this item of equipment in conjunction with those covering item B-3 may indicate that it would be more economical to dispose of one piece of equipment and hire outside equipment to perform the additional work above and beyond the normal operating time, estimated at 1,500 hours.

The examples enumerated above are not intended to be all-inclusive, but merely to indicate what may be revealed for corrective action through a system which provides adequate records and, what is more important, a proper follow-up through analysis and interpretation of the records.

Conclusion

It is the writer's opinion that, in view of the large capital investment involved, together with high costs of operating and maintaining mechanical and motorized equipment, it is absolutely essential to develop and support an adequate cost system to provide reliable facts as an aid and guide to management.



Left. *A plywood boat for river travel in France, to be fitted with an outboard motor.*

Courtesy, Centre technique du Bois

Below. *A prototype model of a molded wooden car body. A limited production of such custom-built cars in this type of wood construction is intended in the United Kingdom.*

Courtesy, " Timber Technolo gy "

Forestry Bibliography

Use and Development of the Oxford Decimal Classification and Co-operation of National Forest Bibliography Centers at International Level

THE JOINT FAO/IUFRO COMMITTEE ON BIBLIOGRAPHY

At its Ninth Session at Oxford in July 1956, the Joint FAO/IUFRO Committee on Bibliography (hereafter the Joint Committee) discussed and approved, together with a first set of amendments to subheadings submitted at the meeting, the whole method of procedure to be adopted for receiving and adjudicating on substantive amendments of the Oxford System of Decimal Classification for Forestry (O.D.C.) and for publicizing those approved by the Committee. It also agreed on further publicizing certain guiding principles for the use of the System, on the form that co-operation between national and international bibliographical centers should take, and on the advice to be given to national centers as to how they should compile their own national lists. All these are set forth below.

Some Guiding Principles for the Use of the O.D.C.

While nothing can replace a painstaking study of the six-page Introduction to the System, the following notes are offered in amplification or emphasis of important points:

1. Before referencing anything or searching a card catalogue, ALWAYS look at the *text* as well as the index of the System.

2. When referencing, it is important to REFERENCE IN DEPTH, i.e., to classify the material in adequate detail, *at the outset*, while the original is still at hand. This will obviate any need for painful recataloguing later on. Do the job once and well. Guide cards or file cases, however, need only be used to the extent necessary. Library shelf-marks call for only shallow (e.g., two-digit) classification, which need not, of course, be the O.D.C. in fact, though it is desirable that the O.D.C. should be used, it is equally possible to employ some other system for the arrangement of library shelves.

3. Keep general matter in general categories but use 'lumped' numbers, e.g., 811/812, as sparingly as possible; likewise the .9 Miscellaneous, numbers, the (0) Form numbers and the - -0 Auxiliary numbers of subject. The two latter are essentially classification tools for really large card catalogues.

4. Any *existing head* may be subdivided domestically, at the risk of the user, the 'domestic' part being either numerical (preceded by x) or alphabetical. But NO unoccupied number at any level, e.g., 21 or 232.411.7, can be so used; these are reserved for possible future use as new official subheads, i.e., to be passed by the Joint Committee. See paragraph 6 b on page 9 of the O.D.C. Introduction.

Some current examples of domestic usage are given below:

(1) *An example of purely numerical subdivision*:
Main head 3. Work Science (Work Studies), etc.
Subhead 304. Hygiene. Safety. Accidents and their prevention
304x0 General
- x2 Accidents and psychology, (e.g. accident proneness)
- x3 Accident statistics
- x4 Accident prevention: safety devices, tools and machines
- x5 Accidents during forestry operations
- x6 Accidents during the transport of wood
- x7 Safety equipment, first aid, etc.
- x8 Hygiene and work
- x9 Miscellaneous

[After Dr. Gläser, Joint Committee on Forest Working Techniques and Training of Forest Workers, FAO/ECE]

(2*a*) *An example of mixed numerical and alphabetical subdivision*:
Main head 1. Factors of the environment. Biology.
Subhead 145.7 Insecta

145.7x13	Taeniothrips laricivorus (where x13 signifies the order Thysanoptera without further numerical subdivision to family)
145.7x19.92	Ips typographus (where x19 signifies the order Coleoptera and .92 the family Scolytidae, a family of great importance to foresters.)

[For the complete scheme, see O.D.C. Appendix C]

(2*b*) *An example of purely alphabetical subdivision*:
Subhead 174.7 Coniferae
174.7 Abies alba
174.7 Abies balsamea
. . . . . .
174.7 Widdringtonia whytei
[See O.D.C., Introduction (1) (d), page 5, and (6) (b), page 9]

5. Since the System allows a certain latitude in e.g., the selection, order and combination of reference numbers, it is advisable to have one person in your institution to standardize your local practice. All local decisions should be kept on record for 'domestic' consultation.

6. While the .0 of any set of numbers has been left open, so far as possible, for future official subdivisions of more general meaning than the heads .1 to .9, the .9 digit is always reserved, at any level, as a *miscellaneous head.* It is an 'overflow' number for any subject that cannot properly be fitted to existing subdivisions and it can itself be subdivided, if necessary, almost *ad infinitum.*

Development of Amendments to the O.D.C.

A. Method of procedure

General

(i) All changes in the O.D.C. require the authorization of the Joint Committee.

(ii) DOMESTIC usage is dealt with in Section 6 (b) of the Introduction to the System.

(iii) Individuals wishing to submit amendments are urged first to consult their national bibliography center and terminology committee (if separate).

Procedure

(i) Any proposals for new or altered subheads are to be submitted to the Joint Committee via the Commonwealth Forestry Bureau (C.F.B.), Oxford, England.

(ii) If the C.F.B. considers, after any necessary correspondence, that a *prima facie* case has been made, it may refer the proposal to an appropriate quarter, e. g. a section of IUFRO, an institute or individual specialists.

(iii) These, after appropriate local consultation, should submit a considered reply to the C.F.B. which will then formulate concrete proposals for the Joint Committee's consideration.

(iv) All such proposals, as well as the correctness of their translation into the four main languages (E, F, G, Span.), will be dealt with at the Joint Committee's next session.

(v) Any decisions taken will be published as expeditiously as possible by the following methods:

(a) by notification in *Unasylva,* reprints being simultaneously sent to all national bibliographical centers in one or other of FAO's official languages, with the request that these be reproduced in the main national forestry and timber periodicals;

(b) by notification in *Forestry Abstracts;*

The standard form will be:

OXFORD DECIMAL CLASSIFICATION FOR FORESTRY

Amendment No...., as authorized by the Joint FAO/IUFRO Committee on Bibliography (place, month and year)

B. First amendment, as authorized at the above session:

OXFORD DECIMAL CLASSIFICATION FOR FORESTRY

Amendment No. 1, as authorized by the Joint FAO/IUFRO Committee on Bibliography (Oxford, July 1956)

182.1 *add* Pollen analysis

232.322.41 *add subdivisions as follows*

.411	Nitrogen fertilizers
.412	Phosphate fertilizers
.414	Potassium fertilizers
.417	Calcium fertilizers; lime
.419	Miscellaneous

237.4 *add* [Subdivide, if necessary, as 232.322.4]

26 *read* COMBINATIONS OF FORESTRY WITH AGRICULTURE AND PASTORAL HUSBANDRY. IRRIGATED AND FLOODLAND FORESTS, SHELTERBELTS ETC., AND THEIR TREATMENT.

263	*read*	Irrigated forests. Forests subject to flooding or seepage (Auewald)
339	*add*	, e.g., salvage fellings
384	*read*	Protective works, including torrent training [For other stream training see 386]
384.2	*read*	Against erosion in general
add 384.3		Torrent training
386		*in square-bracketed comment, read* [For torrent training see 384.3, for installations...]
add 450		General matters. Predisposing factors and causes (including forecasting of outbreaks). [Cross-reference to other subdivisions of 45, as appropriate]
644.9	*add*	, e. g., forest rights (servitudes) etc. [cf. 935.5]
822.45	*delete*	Re-saws and *read* Head saws, break (ing)-down saws
822.46	*read*	Other rip-saws; re-saws, edgers, etc.
945.39	*add*	, e.g., information on careers in forestry

Co-operation between National and International Bibliographical Centers

Preface

At its Ninth Session the Joint Committee examined the reports submitted, at its request, by the three international centers of Oxford, Reinbek and Washington, outlining their functions, and then discussed the form that co-operation between them and national centers should take. These reports are reproduced below:

Functions of International Bibliographical Centers

Scope

The library of the United States Department of Agriculture at Washington, with a branch at Madison to serve those engaged in research, differs from the international centers at Oxford and Reinbek in that it is not devoted exclusively or primarily to forestry. Any changes in methods or systems for forestry literature consequently affect the operation of the entire library.

Oxford and Reinbek scrutinize and abstract literature that carries material of interest to forestry. Oxford does this for all publications in every language — currently some 30 languages are dealt with; Reinbek covers 46 countries and 19 languages. Washington collects, indexes (currently in 13 languages) and lists all publications in the over-all field of agriculture.

Distribution of information

Oxford

i) Quarterly *Forestry Abstracts* from world literature, with regular review articles.

ii) Week-by-week, postal 'Centralized Title Service' of 5×3 in. reference cards, with full O.D.C. classification and bibliographical citation, and often carrying short abstracts; available at cost price. Annual output 6,000 to 7,000 cards per set.

iii) Information service, photocopy work, occasional translations.

Reinbek

i) From 1950-55, Numbers 1 to 8 of the *Bibliographie des ausländischen forst- und holzwirtschaftlichen Schrifttums* (Bibliography of Foreign Literature on Forestry and Timber Economy) classified on the Flury system for silviculture and the Kollmann system for timber. From 1955, a new two-monthly issue using the O.D.C., each containing over 500 titles. The end-of-year issue contains a list of periodicals and an author-index. N.B. For Germany itself a complete bibliography is published annually by the *Zentralstelle für Forstliche Bibliographie*, (Forestry Bibliography Center), Freiburg i. Br.

ii) Publication six times a year of abstracts (*Referatenorgan*) of world forest literature is under preparation.

iii) Extracts, reports, translations, photocopies of literature cited and copies of index cards are available on payment; also information on scientific publications and summaries of literature on specific problems.

Washington

i) Monthly *Bibliography of Agriculture* (a current list by subject; monthly author index, annual subject and cumulative author index).

ii) Lending, reference, bibliographic and photo-reproduction service.

The Committee expressed the wish that Oxford, Reinbek and Washington should explore common grounds for closer co-ordination in the interests of avoiding duplication of effort and of mutually more rewarding results. The Committee feels, however, that there is room in forestry for several centers functioning internationally.

Co-operation with National Bibliographical Centers

Where national centers publish regularly a title list of national forest bibliography, such lists should be produced with as little delay as possible and a copy sent to the international centers for checking against their own coverage lists. In the case of national centers that do not yet publish title lists, the Committee expressed the wish that these undertake to check whether the international centers adequately cover their country's forestry literature. Following this check, they should regularly bring to the notice of the international centers:

(i) any missing periodicals or series, *whether purely forestry or not*, that regularly or from time to time carry material of forestry significance;

(ii) any important missing items (e.g., books, monographs) of forestry significance.

National centers in each country should take steps to have their own literature, both present and past, systematically indexed by subject, using the O.D.C. system from January 1951; and to see that such lists have the appropriate abstract reference(s) appended to any item for which an abstract exists.

Recommendations for Compiling National Bibliographies

Letter G/F-14 dated 8 May 1954 from the Director-General, FAO, to all member countries, offered some initial guidance on the compilation of national bibliographies in the form of title lists. After further consideration by the Joint Committee, the following recommendations are made in amplification, in the hope of ensuring a reasonable minimum of uniformity and *so rendering the bibliographies of maximum utility to both national and international users*:

Recommendations

1. *Scope of the bibliography*

First, by the term 'national forestry bibliography' is to be understood a list of the literature *actually published in that country*, i. e. EXCLUDING material published (a) about that country, and (b) by a national of that country but appearing in some foreign publication; should, however, the national

bibliographical centers prefer to include such references, the fact should always be stated in each issue and the country of publication clearly indicated for each reference.

2. *Periodicity*

Bibliographies should be produced at least annually and as promptly as their completeness will allow; supplements should be avoided.

3. *Classification*

(a) While it is not necessary to publish a detailed decimal classification of each bibliographical reference, a nominal subject classification according to the O.D.C., at about a 2- to 3- figure level, is highly desirable. If so classified, an author index will be essential.

(b) If no subject classification is employed, references should be alphabetically by AUTHOR rather than by any other method.

In both the author index and the bibliography arranged by authors, references in which no author is mentioned should be *grouped under the Latin word* ANON-(YMUS) and arranged in a single alphabetical series by periodical title or (for non-periodicals, including books) by publishing body (*not* by title of the book). Title of publishing body may be abbreviated.

For example, in the case of Germany:

ANON

Bauzeitung (periodical)
Bayer. Stforstverw. (serial)
Bundesanst. Forst- u. Holzw. (serial)
Dtsch. Baumschule (periodical)
Deutscher Ammoniak Vertrieb (book)
Deutscher Forstwirtschaftsrat (serial)
Forst- u. Holzw. (periodical)

4. *Details of citation*

Each reference should include the following essential data:

(1) Author(s), if any, in CAPITAL LETTERS.
(2) title of article or work IN FULL; if this is not in English, French, German or Spanish, a translation in one of these would be welcome.
(3) name of periodical or of series set, or if books, monographs, etc., name of publisher and place of publication.
(4) the usual details of volume or series number, edition number, year, pages, etc.
(5) current price, at least of books.

For example:

JABLOKOV, A. S. Šlechtění dřevin se základy lesního semenářství: Část I. Genetika. [The Selection and Breeding of Trees, with the Bases of Forest Seed Husbandry: Pt. I. Genetics.] *Lesn. Knihovna (malá Rada)* No. 45, 1954. pp. 197. Price Kčs. 16.90.

ANON items, which are grouped under the letter A(NON) should have a full or abbreviated form of periodical title or of publishing body in place of author, and then follow the above order, omitting 4 (1).

For example:

[ANON: DANM. GEOL. UNDERS.]

Studies in vegetational history in honour of Knud Jessen, 29th November 1954. *Danmarks Geologiske Undersögelse (Ser. 2), Köbenhavn* No. 80, 1954, pp. 308 + 21 plates. Price Kr. 16.

SPECIAL NOTE ON AUTHOR CITATION

General

Besides the surname, at least the initial letters of an author's other names must be given.

Names in Spanish or Portuguese

If only ONE surname is given, this must always be distinguished from the Christian name(s), e. g., by using initial letters only for the latter.

Names in French

The M. for 'Monsieur' must not be used in a position where it could be mistaken for the initial letter of a Christian name.

5. *Size and format*

For bibliographies published in book form, the size and format should be as nearly as possible those adopted by the German National Bibliography Center. If the references are published as separate *cards*, these should measure 125 × 75 mm. (5 × 3 in.). It is not essential that bibliographies be printed, especially if other means of reproduction, e.g. mimeograph, can obviate 1 or 2 months' delay. But the paper must be of good quality.

Commodity Report

Fibreboard

The last report on fibreboard appeared in the March 1954 issue of Unasylva. *This present report, which deals with the evolution of world production, consumption and trade in fibreboard up to the end of 1955, is based on a paper prepared by the FAO Secretariat for the International Board Consultation held in Geneva from 21 January to 4 February this year. It includes some new information submitted to the Consultation by participants. The next issue of* Unasylva *will contain a first commodity report on particle board, again based on a paper prepared by FAO for the Board Consultation and on the contributions to the discussion at the Consultation made by participants.*

Production

Though the beginning of the fibreboard industry dates back half a century, large-scale commercial production — of both compressed and non-compressed fibreboard — only developed between the wars, in the United States.[1]

As early as 1898 a plant to manufacture " hardboard " was established in the United Kingdom, a similar plant followed in 1908 in New Jersey, and a plant was set up in Canada in the year 1909. The production of porous fibreboard did not start in the United States of America until 1914, but the insulation-board industry in the United States expanded rapidly in the early 'twenties.

The first major hardboard plant came into production at Laurel, Mississippi, in 1926. From less than 2,000 metric tons in that year, output in the United States rose to 25,000 metric tons in 1929. However, demand only grew slowly and by 1939 production was no more than 54,000 tons. Thus, at the outbreak of the second world war, insulation board was still far and away the most important fibreboard product, hardboard accounting for less than a tenth of the total United States output of fibreboard.

Meanwhile, the fibreboard industry began to develop rapidly in Scandinavia, the first plant coming into operation in Sweden in 1929. By 1939, fourteen mills had been established in the three northern countries with a capacity totalling around 160,000 tons, slightly more than half of this being hardboard. In the late 1930's, mills began to be established in various other countries and the pattern of the world fibreboard industry on the eve of the war was approximately as shown in Table 1.

TABLE 1. — WORLD FIBREBOARD PRODUCTION IN 1938 (in thousands of metric tons)

Region	Compressed	Non-compressed	Total
Europe			
Three northern countries	50	69	119
Remainder of Europe	15	34	49
North America			
U.S.A.	50	550	600
Canada	—	34	34
U.S.S.R.	—	3	3
Oceania	11	7	18
WORLD	126	697	823

At this time, then, world production of fibreboard was still well under a million tons, and pretty well confined to North America, Europe and Oceania (in fact, Australia). The United States alone accounted for three fourths of world output. United States utilization of treated insulation board as exterior sheathing in residential building was the leading application of fibreboard at this time. Significant, perhaps, is the fact that already Europe was producing more hardboard than was the United States of America. Eighty-five percent of all fibreboard produced in 1938 was

[1] To some readers a word of explanation concerning nomenclature may be necessary. Previous reports on fibreboard in this journal have referred to the two main groups of products of this industry as *insulation board* and *hardboard*, and these two terms are freely used in this present report. However, the recent International Board Consultation noted that the presently-used classification *hardboard* and *insulation board* no longer adequately described the range of products so named nor the uses made of these products. It recommended the adoption of the alternative classification *compressed* and *non-compressed fibreboard*, a nomenclature likely to be adopted in several European countries in the near future. The advantages of this alternative nomenclature are that it is technically sound, understandable by the consumer, and provides non-conflicting subdivisions. Thus non-compressed fibreboard includes both rigid and semi-rigid insulation board, while compressed fibreboard comprises semi-hardboard, hardboard and superhardboard. In the present report, which introduces these recommended terms to a wider public for the first time, the terms non-compressed fibreboard and insulation board are interchangeable, as are the terms compressed fibreboard and hardboard, the latter including all three density ranges — semi-hardboard, hardboard and super-hardboard.

insulation board. It should not be overlooked that in the United States hardboard production was limited to one company until after the war, because of patents.

Over most of Europe the war halted developments, but expansion continued in Sweden, and, to a lesser extent, in Finland and Norway. Between 1938 and 1948, capacity in the northern countries almost trebled. Elsewhere in Europe new plants sprang up after the end of the war. By 1948, Europe was producing over half a million tons of fibreboard, of which three fifths was hardboard. The majority of the new capacity added since 1938 was for hardboard.

Meanwhile, production of both hardboard and insulation board continued to grow in the United States, output in 1948 being over half a million tons greater than a decade earlier; rather more than half of the increase was in hardboard, which in 1948 accounted for nearly 30 percent of total fibreboard output against less than 10 percent in 1938. In Canada, too, production rose by some 91,000 tons, of which hardboard — not produced before the war — represented 38,000 tons.

In Oceania, output nearly doubled, with expansion in Australia and the establishment of the first mill in New Zealand. In Africa and Latin America, no fibreboard was yet being produced, but several small capacity plants had been established in the Far East, nearly all in Japan.

Table 2. — World Fibreboard Production in 1948 (in thousands of metric tons)

Region	Compressed	Non-compressed	Total
Europe			
Three northern countries	197	150	347
Remainder of Europe	113	56	169
North America			
U.S.A.	331	821	1 152
Canada	38	87	125
U.S.S.R.	4	3	7
Oceania	18	17	35
Asia	10	5	15
World	711	1 139	1 850

Thus, by 1948, world production had more than doubled compared with a decade earlier and was approaching 2 million metric tons. The United States of America was still far and away the largest producer, but its share of world production had fallen from 73 percent to 62 percent, while that of the three northern European countries had risen from 14 percent to 19 percent. Nearly three fifths of the increased output occurred in hardboard, which now accounted for over 38 percent of the world total as against 15 percent a decade earlier, having outstripped insulation board in all regions save North America.

In the course of the next seven years, output of both hardboard and insulation board expanded all over the world. In 1955, for the first time, fibreboard production topped three million tons. This was not far short of capacity — estimated at over 3.5 million tons — having regard to the rate at which mills were being established or enlarged, and taking into account the necessary running-in time.

Provisional estimates of world production in 1955 are set out in Table 3.

Table 3. — World Fibreboard Production in 1955 (in thousands of metric tons)

Region	Compressed	Non-compressed	Total
Europe			
Three northern countries	476	176	652
Other	391	163	554
North America			
U.S.A.	485	1 012	1 497
Canada	62	134	196
U.S.S.R.	50	30	80
Oceania	81	15	96
Africa [a]	55	15	70
Asia	25	15	40
Latin America	30	10	40
World	1 655	1 570	3 225

[a] Almost entirely Union of South Africa.

Two things will be at once remarked. Firstly, though still the largest individual producer, the United States now accounts for less than half the world output. Secondly, production of hardboard has risen much more quickly than that of insulation board, so that hardboard today accounts for over half of all fibreboard produced.

Table 4 shows, by regions, the development of world fibreboard production over the decade 1946-1955. Some preliminary estimates for 1956 are included.

Between 1946 and 1956, world production of fibreboard rose by over 150 percent. The only setback was in 1952, when fibreboard shared the fate of practically all forest products in that year. Even in 1952, however, it was the three exporting countries of northern Europe that bore the brunt; elsewhere production declined only slightly or continued to expand. Since 1952 steady progress has been recorded in all regions.

The steady decentralization of the fibreboard industry is illustrated in Table 5.

The pattern of distribution, and the evolution of that pattern, is similar to that of world pulp output; if anything, decentralization is proceeding more rapidly. In addition to a significant increase in the share of the three northern countries, there has been an equally

Table 4. — World Production of Fibreboard, 1946-1956, by Regions
(in thousands of metric tons)

Region	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956 (a)
Europe	*347*	*422*	*516*	*548*	*697*	*903*	*755*	*847*	*1 063*	*1 206*	*1 270*
of which:											
3 northern countries	274	304	347	337	415	527	383	455	588	652	675
remainder of Europe	73	118	169	211	282	376	372	392	475	554	595
North America	*947*	*1 070*	*1 277*	*886*	*1 236*	*1 321*	*1 333*	*1 417*	*1 534*	*1 693*	*1 756*
of which:											
Canada	80	97	125	125	130	169	149	166	167	196	216
U.S.A.	867	973	1 152	761	1 106	1 152	1 184	1 251	1 367	1 497	1 540
U.S.S.R.	*2*	*7*	*7*	*9*	*10*	*15*	*25*	*40*	*54*	*80*	*117*
Oceania	*12*	*20*	*35*	*40*	*53*	*53*	*61*	*15*	*90*	*96*	*103*
Asia	*15*	*15*	*15*	*30*	*20*	*20*	*20*	*15*	*35*	*40*	*46*
Africa	—	—	—	*5*	*10*	*15*	*25*	*40*	*50*	*70*	*25*
Latin America	—	—	—	*10*	*10*	*10*	*10*	*20*	*30*	*40*	*50*
World Total	*1 323*	*1 544*	*1 850*	*1 528*	*2 036*	*2 337*	*2 229*	*2 454*	*2 861*	*3 225*	*3 417*

a) Provisional figures.

striking increase in the share of the rest of Europe, especially in the last seven years as new mills and added capacity have come into operation in the United Kingdom and in continental Europe — east and west.

Table 5. — Regional Shares of World Fibreboard Production, 1938, 1948 and 1955
(percentage of total)

Region	1938	1948	1955
North America	77	69	52
of which U.S.A.	(73)	(62)	(46)
Europe	20	28	38
of which three northern countries	(14)	(19)	(20)
All other regions	3	3	10

Table 6 brings out the rise in the importance of hardboard since 1938:

Table 6. — Compressed Fibreboard as Percentage of Total Fibreboard Production, 1938, 1948 and 1955

Region	1938	1948	1955
North America	8	29	32
Europe	39	60	72
Other regions	52	56	74
World	15	38	51

The United States of America in 1955 accounted for 65 percent of the world output of insulation board, but for only 29 percent of total hardboard production.

Fibreboard production capacity today exceeds 4 million tons. Estimated capacity in the several regions is given in Table 7.

Table 7. — World Fibreboard Production Capacity, 1955/56
(in thousands of metric tons)

Region	Compressed	Non-compressed	Total
Europe	*1 105*	*420*	*1 525*
of which: 3 northern countries	625	240	865
rest of Europe	480	180	660
North America	*730*	*1 285*	*2 015*
of which: Canada	100	165	265
U.S.A.	630	1 120	1 750
U.S.S.R.	*90*	*70*	*160*
Oceania	*95*	*20*	*115*
Asia	*35*	*15*	*50*
Africa	*65*	*20*	*85*
Latin America	*60*	*5*	*65*
World	*2 180*	*1 835*	*4 015*

Plans for expanding fibreboard production have been reported from all parts of the world, notably North America, northern Europe, eastern Europe, the U.S.S.R.

and Japan. By the end of 1957, Asian capacity will exceed 80 thousand tons, with the completion of new projects in Japan, Formosa and the Philippines. U.S.S.R. capacity is planned to reach 430 thousand tons (of which 200 thousand tons compressed board) by 1960. This will still be insufficient to meet rising domestic needs, and a similar expansion is expected in the succeeding quinquennium. Capacity targets for 1960 in Poland and Czechoslovakia are 106 and 60 thousand tons respectively. It is impossible to quantify all reported expansions since they range from mills already under construction to projects which have not passed the stage of preliminary investigation. It seems almost certain, however, that by the end of the current decade world capacity will have risen to 5 million tons, of which probably close on 3 million tons will be hardboard.

World trade in fibreboard

The majority of fibreboard produced is consumed domestically, and a relatively small part of world output enters into international trade. In 1955, only 11 countries exported on a significant scale (over 5,000 tons); in only five of these countries (Austria, Belgium, Finland, Norway and Sweden) is the fibreboard industry largely directed to the export market.

Table 8 shows the course of world exports of fibreboard from 1946 to 1956, the principal exporters being listed separately.

About one sixth of all fibreboard produced enters into international trade. North American exports have remained relatively steady; for the most part these consists of border trade between Canada and the U.S.A. Sweden alone accounts for over half of all world exports, and Finland and Norway together for another 15 percent. Like all forest products, fibreboard was badly hit by the slump which followed the 1950-51 boom. By 1954, however, exports had exceeded their previous peak level, and a further substantial expansion was recorded in the following year. Imports of fibreboard are naturally more scattered geographically. Even so, only 12 countries in 1955 imported more than 5,000 tons. The pattern of world imports of fibreboard since 1946 is shown in Table 9.

The United Kingdom has consistently been the largest importer of fibreboard throughout the decade, accounting in 1955 for more than half of Europe's imports. Next in importance comes the Netherlands, with an import of 56,000 tons in 1955.

The bulk of the world's trade in fibreboard is thus intra-European, the main flow being from northern Europe to western Europe. Northern Europe is also a principal supplier to other importing regions, though smaller flows from Austria, certain western European countries and Canada supplement Scandinavian supplies.

One serious warning must be entered concerning these trade figures. A comparison of world import with world export totals shows a consistent deficiency in the

TABLE 8. — EXPORT OF FIBREBOARD, 1946-1956
(in thousands of metric tons)

Region	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956 (*a*)
Europe	*101*	*119*	*145*	*158*	*234*	*338*	*205*	*239*	*367*	*453*	*485*
of which:											
Austria	2	3	3	6	6	9	5	7	17	23	21
Belgium-Luxembourg	—	4	4	6	8	12	10	18	25	35	36
Czechoslovakia	—	2	2	2	—	—	1	2	3	10	10
Finland	21	24	27	31	50	68	44	45	59	61	49
Netherlands	—	—	—	0.2	4	9	8	6	7	11	12
Norway	6	5	10	9	14	24	17	22	24	27	37
Sweden	69	76	95	98	138	183	105	127	213	260	298
North America	*61*	*83*	*74*	*53*	*28*	*42*	*40*	*37*	*39*	*67*	*60*
of which:											
Canada	38	47	41	32	6	20	18	17	16	43	35
U.S.A.	23	36	33	22	21	23	23	20	23	24	25
Oceania	*2*	—	*2*	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Africa (Union of S. Africa)	—	—	—	—	—	—	*5*	*10*	*15*	*20*	*25*
Other regions	—	—	*1*	*2*	*1*	*1*	*2*	*3*	*3*	*7*	*8*
WORLD TOTAL	*164*	*202*	*222*	*214*	*265*	*383*	*254*	*291*	*426*	*549*	*580*

a) Provisional figures.

Table 9. — Imports of Fibreboard, 1946-1956
(in thousands of metric tons)

Region	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956 (a)
Europe	*78*	*76*	*101*	*96*	*163*	*211*	*133*	*174*	*271*	*334*	*315*
of which:											
Belgium-Luxembourg	6	7	8	11	13	13	14	15	19	20	19
Denmark	12	9	7	16	11	16	13	18	22	25	23
France	4	5	3	—	5	9	10	14	14	15	18
Western Germany	—	—	1	2	3	2	8	13	15	20	30
Italy	—	—	2	0.4	0.3	0.3	2	4	7	7	6
Netherlands	13	15	26	24	30	31	26	36	54	56	59
United Kingdom	37	34	49	37	94	131	55	67	127	171	141
North America	*32*	*44*	*33*	*53*	*37*	*33*	*34*	*37*	*38*	*42*	*61*
of which:											
Canada	7	14	7	34	12	8	11	17	21	21	27
U.S.A.	26	29	27	20	25	24	24	20	17	21	34
Oceania	—	*1*	*2*	*11*	*12*	*27*	*19*	*1*	*2*	*7*	*10*
Asia	*17*	*30*	*2*	*91*	*13*	*13*	*15*	*20*	*32*	*44*	*50*
Africa	—	*2*	*4*	*8*	*6*	*8*	*9*	*11*	*14*	*18*	*20*
Latin America	*4*	*6*	*5*	*5*	*3*	*2*	*3*	*5*	*5*	*4*	*5*
World Total	*131*	*159*	*147*	*187*	*234*	*294*	*213*	*248*	*362*	*459*	*461*

a) Provisional figures.

former. The export figures of those countries in which the fibreboard industry is well-established are certainly more reliable. In the trade accounts of many importing countries, fibreboard imports are not yet recorded separately, being classified under a variety of headings — paperboard, miscellaneous wood products, etc. This statistical deficiency needs to be borne in mind in interpreting the trade figures. It also leads to an underestimate of apparent consumption (production plus or minus trade balance) in many of the importing areas.

The pattern of world production and trade in fibreboard is similar in many ways to that in pulp and paper; the same heavy concentration of production in Europe and North America; the same dependence in other regions on external sources of supply. But Canada is so far not a large contributor of fibreboard to other regions, and the U.S.A., which has emerged with a substantial net export of pulp in recent years, so far exports insignificant amounts of fibreboard overseas. One recent development is worth remarking, since it may be a portent. In the last year or so, small quantities of fibreboard have been sold or offered to Europe from places as remote as Brazil and New Zealand, while South Africa has readily built up a useful export trade to this market. This challenge to the Scandinavian exporters on their very doorstep is significant; it points to the opportunities for new trade flows and longer-range competition in other areas of the world.

It is perhaps surprising at first sight that as much as 17 percent of world production of fibreboard is traded internationally. A fibreboard plant is much less costly to install than a pulp or paper mill; its raw material requirements are a good deal less exacting. Since fibreboard is fairly cheap in relation to its volume, freight costs (including insurance and packaging) bear heavily. This would lead one to suppose that imported fibreboard would find it difficult to complete with the indigenous product.

Three main factors account for the continued expansion of international trade in fibreboard. First, over most of the world national markets for fibreboard are still small and its uses largely experimental. Neither hardboard nor insulation board are uniform products; each category embraces a wide variety of boards involving differences in processing in many cases. The total consumption of all types of fibreboard is no criterion of the potential market for a particular plant manufacturing specified products. Hence imports tend to increase until prospective markets have matured to the point at which they will support indigenous production. The establishment of a new mill will seldom satisfy the demand for all board categories. Indeed, the very appearance of domestic supplies may encourage more

extensive use and stimulate, rather than replace, imports.

Secondly, a related point, the economies of size in fibreboard production are considerable.[2] In northern Europe, the principal exporting region, there has been a marked tendency towards larger production units in recent years with a consequent fall in average production costs measured in constant prices. Larger-scale, lower-cost production has reduced the protection afforded by distance and freights.[3] Hence, the minimum economic size for a new project in an importing country — the size at which its product can successfully compete with the imported product — has increased.

Finally, in many importing regions the imported product may have a quality advantage. This stems less from the raw material employed than from the acquired skill and experience in controlling the production process. High quality and special purpose fibreboards should continue to find outlets, however rapid the decentralization in world production.

At the same time, the quality advantage which board from the traditional exporting centers enjoys in overseas markets must not be exaggerated. Indeed, experience in Australia and New Zealand shows that, on the whole, imported boards, while cheaper, fall short of the standards set by domestically produced board. This may, of course, be due to the fact that the highest quality foreign production is directed to more highly competitive markets, so that the boards actually competing in Australia and New Zealand with domestic boards are not fully representative of the output of the established exporting regions. In any case, Australia and New Zealand are in no sense undeveloped countries; countries in Asia, Africa and Latin America starting on board production for the first time will have more reason to take into account possible quality differences. Even so, the importance of quality must not be overestimated, since in underdeveloped countries the number of uses which, in practice, demand a high grade board with outstanding strength properties is likely to be limited; for most purposes average quality board will suffice. Resistance to weather, decay and insects are likely to be more important considerations.

Clearly, the impact of several of the factors mentioned above must weaken with the passage of time. Thus though the absolute level of world trade in fibreboard may rise, in the long run one must expect that a falling proportion of world production will enter into long-distance trade.

Prices

The price of fibreboard over the last two decades has risen much less than that of other forest products, and has been subject to less serious fluctuations. Indeed, in relation to commodity prices generally, fibreboard has become progressively cheaper. The opportunities for reducing costs in a new industry through technical progress are great, and with the multiplication of producing units competition has ensured that these economies have been translated into price.

Table 10 shows the changes which have taken place in the price of hardboard and insulation board respectively in Sweden since 1937. The Table also shows the relationship between fibreboard prices and wholesale prices generally, taking March 1937 as 100.

Table 10. — Swedish Fibreboard Prices and Wholesale Price Index, 1937-1955
(1937 = 100)

Year		Hardboard (1/8 in.) A	Insulation board (1/2 in.) B	Wholesale price index C	Hardboard index (A/C)	Insulation board index (B/C)
1937		100	100	100	100	100
1938		94	92	97	97	95
1948		119	135	188	63	72
1951	Feb.	155	173	262	59	66
	July	177	200		68	76
1952		158	185	278	57	67
1953		129	173	261	49	66
1954		139	173	261	53	66
1955		139	173	271	51	64

This Table shows that in real terms the price of hardboard has halved while that of insulation board has fallen by one third since 1937.

Even more striking is the comparison between the trend of fibreboard prices and that of sawnwood prices, shown in Table 11.

Sawn softwood prices, at their peak level in 1951, reached seven times their 1937 level and were roughly double the 1947-48 level. Fibreboard prices, at their peak, were less than double their prewar level and less than 50 percent higher than those prevailing in 1947-8. In 1956, sawnwood prices were still 95 percent higher than in 1947-48, while fibreboard prices were 7 percent lower. Undoubtedly, fibreboard's relative cheapness and steadines in price have greatly contributed to its extended use.

With the fibreboard industry approaching maturity, opportunities for production economies become fewer.

[2] By way of example, data submitted to the International Board Consultation indicated that, other things being equal, the *total* production costs per ton for a 30-ton/8-hour mill producing hardboard are roughly the same as the *direct* production costs per ton (i. e., excluding fixed charges) for a 7-ton/8-hour mill. In other words, given similar unit costs for raw material, labor, power, etc., the smaller mill could only just compete with the larger even if its equipment and buildings were supplied free.

Hasty conclusions should not be drawn from this example. Other things are seldom equal. Small plants may have access to cheaper raw material supplies; if they have been in operation some years, much of the initial investment may have been written off; and so forth. Yet the example does serve to illustrate the economies of size.

[3] Since sea freights are on a volume basis, the freight (and hence the protection) is about three or four times as great on insulation as on hardboard.

Table 11. — Development of Fibreboard Prices Compared with Sawnwood Prices (1947-48 = 100)

Year	Sawn softwood (1)	Hardboard (2)
1949	99	100
Half year		
1950: 1st	122	100
2nd	169	100
1951: 1st	200	130
2nd	214	148
1952: 1st	150	148
2nd	174	103
1953: 1st	177	100
2nd	178	97
1954: 1st	185	94
2nd	189	93
1955: 1st	198	93
2nd	195	93
1956: 1st	195	93

(1) Index of Swedish export prices f.o.b. for 2½″ × 7″ u/s redwood battens.

(2) Index of Swedish prices for 1/8″ hardboard.

Table 12. — World Consumption of Fibreboard in 1955

Region	Production:	Imports:	Exports:	Apparent consumption:	
	in thousand metric tons			*in kgs/head*	
Europe	*1 206*	*334*	*453*	*1 087*	*2.7*
3 northern countries	652	—	349	303	20.5
Others	554	334	104	784	2.0
North America	*1 693*	*42*	*67*	*1 668*	*9.3*
USA	1 497	21	24	1 494	9.2
Canada	196	21	43	174	11.4
U.S.S.R.	*80*	—	—	*80*	*0.37*
Oceania	*96*	7	2	101	7.0
Africa	*70*	*18*	*20*	*68*	*0.32*
Union of S. Africa	70	1	20	51	3.8
Asia (excl. China)	*40*	*44*	*5*	*79*	*0.09*
Latin America	*40*	*4*	*2*	*42*	*0.24*
World	*3 225*	*449*	*549*	*3 125*	*1.5*

Note. The figures in this and succeeding Tables, and those quoted in the accompanying text, slightly understate consumption, especially that in the less-developed regions. Moreover, all the consumption figures quoted are of apparent consumption, i.e. not taking into account changes in stocks at mills or in the hands of distributors and consumers.

Finally, it should be noted that consumption includes utilization in further manufacture — part of which may be destined for export. Thus, since the three northern countries, for example, export prefabricated houses containing fibreboards, the per capita consumption figures quoted here overstate final consumption by the nationals of those countries.

The declining curve of fibreboard prices (in relation to prices generally) must therefore be expected to flatten out in the coming years.

Intense competition between mills has played a big part in bringing about the reduction in the relative price of fibreboard which has taken place over the last two decades. With each reduction, the competitive power of fibreboard vis-a-vis alternative materials has increased, and the potential market has widened. A comparison of the widely differing use practices in various parts of the world suggests that, even at present prices, the potential market is far from being exhausted.

Consumption

The world today (excluding China) consumes nearly 3.5 million tons of fibreboard, representing an average consumption of about 1.5 kilograms per head. Apparent consumption in 1955 ranged from over 20 kilograms per head in northern Europe to less than one tenth of a kilogram in Asia.

The contrast between the regions where fibreboard production is most highly developed (North America, Europe and Oceania) and the rest of the world is brought out in the following Table:

Table 13. — Concentration of Fibreboard Production and Consumption in 1955

Region	Percentage shares of:			Consumption per head, in kg.
	Population	Fibreboard production	Fibreboard consumption	
N. America, Europe and Oceania	29	93	91	4.78
Rest of world (excl. China)	71	7	9	0.18

The United States of America is still the biggest market for fibreboard, followed by the United Kingdom, Canada, Sweden, Western Germany, France and Australia, in that order (Table 14).

The changes recorded in consumption per head in certain countries since 1948 reveal some interesting features (Table 15).

The gap in fibreboard usage between Sweden and the other northern countries has closed considerably in recent years. Canada has overtaken the U.S.A., where consumption per head has not shown any great increase. Remarkable advances have been registered in Australia and New Zealand, as also, though to a lesser extent, in several western European countries. The upward trend is even more evident if the countries are listed in consumption groups for each period.

Table 16 throws some light on future market prospects for fibreboard. It is evident that there is a great potential for increased consumption in east and west Europe, in the United States of America and in all the less-developed regions. At the same time, it would be dangerous to assume that the high consumption rates recorded in northern Europe, Canada and New Zealand are realizable in other countries. In these countries climatic

TABLE 14. — FIBREBOARD MARKETS IN 1954/55
(in thousands of metric tons annually)

1,000,000 +		100,000 +		50,000 +		20,000 +		10,000 +	
Country	TOTAL	Country	TOTAL	Country	TOTAL	Country	TOTAL	Country	TOTAL
U.S.A.	1 478	U.K.	198	W. Germany	95	Union S. Africa	46	Japan	17
		Canada	174	France	85	Italy	43	Israel	15
		Sweden	160	Australia	73	Poland	40	Argentina	14
				Finland	71	Belgium	30	Malaya	12
				U.S.S.R.	70	Denmark	26	Ireland	11
				Norway	69	Czechoslovakia	25	Hungary	11
				Netherlands	66	E. Germany	23	Yugoslavia	11
						New Zealand	23		
						Austria	22		
						Spain	20		
						Switzerland	20		

TABLE 15. — ESTIMATED FIBREBOARD CONSUMPTION IN SELECTED COUNTRIES, 1948-55
(in kilograms per head)

Country	1948	1952/3	1954/5
Sweden	14.7	18.2	22.1
Norway	9.1	17.9	20.0
Finland	6.4	12.1	16.8
Canada	6.9	10.6	11.4
New Zealand	1.1	10.3	10.9
United States	7.8	7.7	9.0
Australia	2.6	6.4	8.0
Netherlands	2.9	3.7	6.1
Denmark	2.1	3.9	5.7
Israel	—	0.9	5.0
Switzerland	2.0	3.1	4.0
United Kingdon	0.8	1.9	3.9
Ireland	0.8	2.7	3.6
Belgium	2.3	2.9	3.4
Austria	1.4	2.4	3.1
Western Germany	0.8	0.9	2.2
France	0.5	1.4	2.0
Union of South Africa	—	2.0	3.4
Italy	0.6	0.8	0.9
Mexico	0.1	0.1	0.3
Japan	0.1	0.1	0.2

TABLE 16. — PER CAPUT CONSUMPTION OF FIBREBOARD IN SELECTED COUNTRIES, 1948-55

Consumption group, in kg. per head	1948	1952/3	1954/5
20 +			Sweden Norway
15 +		Sweden Norway	Finland
10 +	Sweden	Finland Canada New Zealand	Canada New Zealand
5 +	Norway U.S.A. Canada Finland	U.S.A. Australia	U.S.A. Australia Netherlands Denmark Israel
3 +		Denmark Netherlands Switzerland	Switzerland U.K. Ireland Belgium Austria Union of S. Africa
2 +	Netherlands Switzerland Australia Belgium Denmark	Belgium Ireland Austria Union of S. Africa	W. Germany France
1 +	Austria New Zealand	U.K. W. Germany France	
— 1	U.K. W. Germany Ireland Italy France Mexico Japan Israel Union of S. Africa	Italy Mexico Japan Israel	Italy Mexico Japan

conditions and building practices have favored the larger-scale use of fibreboard instead of sawnwood and plywood. The same is true, of course, of the United States, though it should be pointed out that one of the reasons for the slower growth in fibreboard consumption in that country is the fact that the supplies of plywood and of lumber in wide and long boards have been more adequate and cheaper than in Europe. In a number of countries the rising particle board industry has captured markets which might have been won by fibreboard. In the coming years particle board will be an increasing rival to fibreboard in many applications.[4] Nevertheless, because use practice today varies so

[4] This point will be discussed further in the Commodity Report on particle board which will appear in *Unasylva*, Volume 11, Number 4.

widely between countries, the upward trend in consumption levels should everywhere be reinforced as knowledge of possible applications becomes more widespread.

Prospects

Fibreboard capacity has risen rapidly since the war, and is still expanding. So much so that manufacturers in a number of countries believe that overinvestment has taken place and that consumption is lagging behind present production potential. Under these circumstances, it is not unnatural that existing producers who depend largely on export markets view with some alarm the establishment of new capacity in regions outside the traditional producing centers. There is a danger that, if the new plants are based on unsound economic lines they may require permanent and excessive protection in order to survive; such instances have already occurred.

Yet fibreboard products are capable of making a considerable contribution towards raising the living standards of the less-developed regions of the world. In many of the countries in these regions, consumption is likely to remain at very low levels so long as the countries concerned have to rely entirely on imports. Any expansion of domestic capacity in these countries will considerably stimulate consumption. Providing presently-importing countries have adequate supplies of suitable raw materials, with the possibility of producing board economically for the markets envisaged, there is a case for new capacity. What is presently known about current and prospective plans for expanding capacity in different countries suggests that, as in the case of pulp and paper, a gradual, if not very pronounced, trend towards decentralization of world fibreboard production will make itself felt in the coming years.

Existing producers face two main problems. The industry as a whole, and the individual producers which comprise the industry, strive to expand existing outlets for its production and to develop new ones. The changes which have occurred in the pattern of fibreboard output reflect the success which fibreboard has met with in finding and developing new outlets. Current production, especially in the U.S.A., comprises a remarkable variety of types with very diverse properties, characteristics and prices.

At the same time, individual producers concentrate on improving the quality of their product to the point where it can compete with those of their competitors and meet specifications where they exist. This gives rise to a trend towards standardized, high quality production. This trend towards a uniform product is more pronounced in Europe than in the United States. There is some virtue, of course, in having a standard product, a recognizable commodity with prescribed and predictable behavior. It facilitates the establishment of codes and specifications and makes for fair competition between products. But there is also a danger that in many applications, especially in novel ones, boards will be employed which possess qualities higher than are strictly required. This may be because codes and specifications are insufficiently tolerant, or it may be because cheaper and lower quality, though yet adequate, boards are not being made. This is irrational use, and, from the standpoint of the community, represents unnecessary waste.

Discussions at the recent International Board Consultation made it abundantly clear that more exact knowledge about fibreboard's applications will be one of the industry's principal preoccupations in the coming years. To determine the physical properties required in particular applications, to devise appropriate testing methods which will gain general acceptance, and to ensure that officially prescribed codes and specifications are based on actual requirements in use: these are the directions in which research must be intensified if the continued growth of the fibreboard industry is to be assured.

It cannot be overemphasized that, though the fibreboard industry is reaching maturity in regard to production techniques and processes, it is still relatively young as regards the applications of its manifold products. Hitherto, demand has been sufficiently strong in normal years to ensure outlets in more or less convential end-uses for all the fibreboard produced. As has already been pointed out, the generalization of current applications alone should ensure the maintenance of the industry's present growth rate for some time to come.

J. C. W.

The Work of FAO

Poplar Congress in France

The Ninth Session of the International Poplar Commission was held under the auspices of FAO in Paris from 22 to 29 April 1957, in the course of a Sixth International Poplar Congress which had been organized by the Government of France. This Congress was preceded by a four-day study tour in the Garonne and Rhone valleys, and followed by short tours in the region east of Paris.

Mr. F. Merveilleux du Vignaux, Director-General of the French Forest Service, opened the Congress at the Palais d'Orsay, to which had come more than 130 delegates from 28 countries spread all over the world. Mr. Ph. Guinier, of the *Institut de France*, and Mr. Marcel Leloup, Director of the Forestry Division of FAO, also addressed the inaugural meeting and gave emphasis to the worldwide importance which poplar cultivation has attained, as evidenced by the results achieved by the International Poplar Commission. Ten years after its creation, this Commission now has a membership of 20 countries, Greece, Lebanon, Pakistan and Yugoslavia being admitted at Paris.

Mr. A. Herbignat, Director-General of the Belgian Forest Service, Mr. Alexander Jablocov, Member of the Soviet Academy of Sciences, and Mr. E. J. Schreiner, of the U.S. Department of Agriculture, were elected Vice-Presidents of the Congress. Mr. A. Guinier, Chairman of the International Poplar Commission, was elected President. Mr. R. Fontaine (FAO) was Secretary.

The Congress received with interest reports regarding many countries. Of particular interest was new information from Hungary, Poland, the U.S.S.R. and Yugoslavia. Stress was laid on the necessity for a better exchange of technical information among the various countries interested in poplars and their cultivation and use, and of the results of experimental work. The opportunity afforded by the Congress marked a useful step in this direction. More attention needed to be given to the problems posed by the intensive cultivation of tree species in plantations outside the forest proper in that these can differ considerably from the problems of silviculture in the strictest sense.

The meetings of the International Poplar Commission itself were concerned with current projects — statistics, the genus *Salix*, nomenclature and registration, experimental methods, pests and diseases, and the harvesting and utilization of poplar timber. It was decided to carry out an international survey on damage caused by the *Dothichiza*, and to create a study group on insect pests on the same lines as the existing study groups on diseases and on utilization. Experiments will be conducted on poplar cultivation in semi-arid areas of the Mediterranean basin and the Near East.

The Commission elected Mr. G. Giordano (Italy) as its new Chairman and Mr. J. Pourtet (France) as Vice-Chairman of the Standing Executive Committee. Special tribute was paid to the retiring Chairman, Mr. Ph. Guinier, who has presided with great authority over the Commission for 10 years and whose retirement is unanimously regretted, and to Mr. G. Houtzagers of the Netherlands, the retiring Vice-Chairman who was prevented by illness from attending the present session but whose contribution to the work of the Commission was always particularly appreciated and valuable.[1]

Development Center on Watershed Management

Following a request of the Asia-Pacific Forestry Commission, the Forestry and Agriculture Divisions of FAO last year jointly started organizing a regional Development Center on Watershed Management. At the invitation of the Government of India, the Center was held in the upper Damodar valley at Hazaribagh, Birah, from 18 February to 15 March 1957, and covered the management of small watersheds through forestry, grassland management, the management of arable agricultural lands and small-scale engineering.

Nine governments of the region nominated participants, comprising 11 foresters, 9 agriculturists and one engineer, drawn from the following countries: Australia (1), Burma (2), Ceylon (2), India (6), Indonesia (2), Japan (2), Pakistan (2), Philippines (2) and Thailand (2). Two special lecturers, Herbert C. Storey, Chief, Division of Watershed Management Research of the United States Forest Service, and John Wetzel, Chief, Small Watersheds Planning Branch, United States Soil Conservation Service, were brought to the Center to present the basic material for the technical program. In addition, a number of guest lecturers were furnished by India and Ceylon, as well as by FAO. T. J. Mirchandani, Director, Department of Soil Conservation, Damodar Valley Corporation, served as Co-director, along with Clark E. Holscher of FAO's Forestry Division and John Blackmore of the Agriculture Division. The Government of India and Damodar Valley Corporation (D.V.C.) were hosts to the Center and respectively were represented by C.A.R. Bhadran, Deputy Inspector-General of Forests, and P. S. Rao, Chairman, D.V.C. Board of Directors.

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[1] It is with regret that we must announce the subsequent death of Mr. Houtzagers in June.

The program of the Center was developed around the concept of land-use planning and management with small watersheds forming the units of management. While a general sketch plan for entire river basins is desirable, detailed plans for action on improvement programs should be based on the small watershed units which make up the entire basin.

Lectures and discussions were held on the following general subjects:

1. Basic concepts of the hydrology of a watershed
2. Application of forestry techniques in watershed control and the role of forestry in watershed planning
3. Application of grazing management and revegetation techniques, the relationship of grazing to agriculture and forestry, and the role of grasslands in watershed management planning
4. Soil conservation techniques in arable land management, the development of farm plans, and the application of improved land use and production practices which will assist in better soil conservation in watersheds
5. Design and use of engineering structures in watershed control and in improved farm, forest and grassland management
6. The overall planning of watershed management projects and the education and extension activities which must be included in such planning.

What can be done. *In 1936 this North Carolina hillside was slowly but surely sliding into highway ditches and stream beds. Fourteen years later it was stabilized and again productive.*

Courtesy, *American Forests*

The last week of the Center was given over to the actual planning of a small watershed. The group of participants was divided into teams of five and each team was assigned the task of developing a plan of improved land use and management, but each with a different set of objectives. For instance, one group was to develop a plan which would serve an irrigation project, another a plan which would give maximum sustained flow of clear water throughout the year, all plans, of course, including adequate soil conservation considerations.

Two of the major problems affecting watersheds in the Asia and Far East region are shifting cultivation and grazing. These problems have social and political as well as technical implications and this emphasizes the need for including watershed management as a part of the forest policy of each country. Shifting cultivation was mentioned repeatedly during the discussions of the Working Party on Watershed Management, a subsidiary body of the Asia-Pacific Forestry Commission, which met during the period the Center was held, and it is likely that this Working Party will devote special study to this subject in the near future.

The papers presented at the Development Center are to be printed by the Soil Conservation Society of India, and will be available, in English, for general distribution. Also, a report on the project is being prepared by FAO and will consist of a synthesis of the knowledge and ideas expressed on the various subjects discussed at the Center.

European Forestry Commission

The European Forestry Commission of FAO held its Ninth Session at Headquarters in Rome from 7 to 14 May 1957. The session was followed by a field tour to study the silvicultural systems and management of Alpine forests, which was kindly organized by the Italian State Forest Service.

Representatives of seventeen Member Governments participated as follows: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Morocco, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom and Yugoslavia. Observers were also present from the United Nations, the Council of Europe, the European Confederation of Agriculture and

the International Union of Forest Research Organizations. Mr. Leloup, Director of the Forestry Division, represented the Director-General of FAO.

The discussions were directed by the Commission's Chairman, Sir Henry Beresford-Peirse (United Kingdom), except for one day when the meeting was presided over by the First Vice-Chairman, Mr. J. Keller (Switzerland). Mr. N. A. Osara (Finland) was appointed Rapporteur for the session.

The Commission first reviewed the activities of its various subsidiary bodies: the Joint EFC/NEFC Sub-Commission on Mediterranean Forestry Problems (*Silva Mediterranea*), the Working Party on Afforestation and Reforestation, the Working Party on Torrent Control and Protection from Avalanches, the Joint FAO/ECE Committee on Forest Working Techniques and Training of Forest Workers and the Joint FAO/ECE Working Party on Forest and Forest Products Statistics.

It then passed to a review of progress in forestry over the past two years in the countries of the region, and discussed the general trends. National progress reports submitted by Member Governments revealed some interesting features. Efforts were indicated as being directed more and more towards:

(*a*) afforestation, at least in the countries of central and southern Europe, considerable areas being planted to poplars;

(*b*) the promotion, in nearly all countries, of the private small woodland and, more generally, towards the integration of private forestry into the national economy;

(*c*) increased productivity by improved efficiency in logging operations and by the setting up of new factories to absorb those forest products that have until now been more or less discarded by industry.

The Commission heard statements by several delegates on the action taken or being taken by their respective governments to adapt forest legislation to current needs and conditions through a revision of existing laws or enactment of special legislation for specific purposes, such as the special law for Calabria (Italy) relating to extraordinary watershed management works to be carried out over a period of 12 years, and which includes financial provisions for research, technical assistance and training of workers. The Commission also took note that a number of Member Governments have taken steps to strengthen or reorganize their Forest Services. The Commission stressed this alertness of governments to adjust legislation and the means for its implementation, that is forest administration, to changing conditions as evidence of the increasing interest of governments in the role that forestry can play for the development of national economies.

Control of the origin and quality of forest seed and planting stock was reported to the Commission as being pursued or initiated in several countries in various ways. The Commission took note with satisfaction that this very important question is now being given due consideration not only by science, as was the case in the past, but also by practice, and that relevant legislative measures are being taken in a number of countries. Consequently, it recommended that the Director-General should draw the attention of Member Governments to the great importance of an efficient control of the origin and quality of forest seed and planting stock to avoid serious mistakes in establishing new forests and, in particular, should urge those governments which at present have no such control to take appropriate measures as soon as possible to remedy the situation.

The Commission discussed at length problems facing small woodlands in Europe.

European governments, it was acknowledged, recognize the great advantages for farmers to have woodlots of a certain size closely linked to the farm economy. In most cases a government's policy is to integrate small woodlands, including farm woodlots, into the general forest policy of the country. If such an integration is to yield fruitful results, agriculture and forest development will have to go hand in hand and not be planned separately, as is often the case at present. Private forests, and especially farm forests, suffer considerably from the present state of affairs, as extraordinary expenses or heavy investments in agriculture are all too often made at the expense of farm woodlots through overcutting. Therefore, the Commission recommended that the need for the integration of agriculture with forestry should be brought to the attention of Member Governments by the Director-General as developments in either of these fields have immediate repercussions on the other, and advocated closer co-operation on this question between the European Confederation of Agriculture and the Commission itself. It also requested that the Director-General should ensure that this problem is tackled by the FAO Agriculture and Forestry Divisions in close collaboration. A report by the Natural Resources Committee of the United Kingdom, entitled *Forestry, Agriculture and Marginal Land*, received special notice.

In spite of the widely different problems relating to small woodlands that confront Member Governments, the Commission agreed that the following measures, if taken, might bring about considerable improvement in the situation in the majority of the European countries:

(*a*) creation of forest groups, syndicates, co-operatives or societies (in accordance with local legislation) to avoid further fragmentation of forest holdings and encourage the consolidation of existing fragmented holdings into economic units to be subjected to intensive management;

(*b*) creation of similar co-operatives for the afforestation of marginal land, the establishment of plantations with quick-growing species outside the forest proper and the inter-planting of the same species in derelict woodlands;

(*c*) conversion of coppices into high forests to enable the production of much more valuable wood categories other than fuelwood;

(*d*) closer co-operation between agriculture and forest services advising farmers;

(*e*) better technical training of forest owners with special reference to silviculture, felling, grading and transport operations;

(*f*) more financial aid to be given to private forest owners by the State in the form of subventions, loans or special funds (in this connexion, the Commission wished to draw attention in particular to the loan system of the *Fonds forestier national* of France to help owners pay inheritance taxes without having to cut or sell part of the inherited forest, to the anticipation system for newly-established plantations adopted in Morocco, and to the Norwegian and Swedish systems of investment funds);

(*g*) development of low-premium insurance policies against fires, pests, diseases and other forest calamities;

(*h*) creation of forest owners' associations whenever possible of the type existing in Northern Europe, which have so far proved to be very effective in solving many of the problems confronting small private forest owners in practically all member countries.

In connection with discussions on planting programs in Europe, the subject of myxomatosis received attention. Myxomatosis has in the past few years reduced considerably the rabbit population in many countries, but its virulence seems now sharply declining. The spread of this disease has been very beneficial from the forestry point of view in all countries where the rabbit was a serious pest, making fencing of newly-established plantations superfluous and thus reducing considerably planting costs, and enabling the forest to re-establish itself naturally in many areas. No definitive conclusions as to the future development of the disease can be drawn as yet, and the Commission recommended that the Director-General should request Member Governments to communicate any more results of their experience on myxomatosis to the *Direction générale des eaux et forêts* in Paris, where there is a special organization studying the development of the disease. The International Union for the Conservation of Nature and Natural Resources has issued a publication on the consequences of myxomatosis.

After dealing with a number of other topics on its agenda, the Commission discussed the problem of the exodus of forest workers to types of lighter and more remunerative work which remained a preoccupation of several Member Governments, although efforts have been made to improve working and living conditions. Member Governments were invited to pursue such efforts for the sake not only of the forest workers but also of the forest and timber industries themselves, whose future is jeopardized by lack of skilled labor. In particular, attention was drawn to the need for better education of workers through apprenticeship schemes and more adequate accident, old-age, and sickness insurance or pension schemes. Wages, in addition, should be brought into line with those of industrial workers insofar as possible. Increasing attention should be given to the technical training of forest workers and private forest owners and to younger generations. The establishment in some countries of school forests adopted by pupils, who look after them and learn the elements of silviculture while at the same time regard for the forest is instilled into them, was regarded as an example to be followed by other Member Governments.

The Commission was pleased to note that the results of national forest inventories conducted recently in a few member countries showed marked increase in the growing stock, giving clear indications of the constructive work of foresters over the years.

In spite of an envisaged decrease in fellings during the next decade in those countries where heavy overcuttings were made during the war and in the postwar period to meet reconstruction requirements, this reduction will in the same period be more than offset by increased fellings in other countries, made possible by the past work of foresters to improve their stands. By 1965, total fellings are likely to reach a new peak, while the volume of industrial wood may exceed the 1950 output by more than 25 percent. This increase is to be ascribed also to a greater proportion of industrial wood out of the total which today's forestry practices makes it possible to obtain.

The Commission congratulated FAO and ECE on the closeness of the forecasts for 1960 made in the study, *European Timber Trends and Prospects*, with those at present available for the same year. It wished to put on record that such closeness was the best justification for the FAO Forestry Division undertaking to assess world wood supplies and requirements for 1975.

The Commission concluded its session with a review of current FAO forestry activities as they affect the European region, and made proposals as to future orientation of the Organization's program of work.

Finally the Commission unanimously elected Mr. Alberto M. Camaiti, Director-General of Mountain Economy and Forests of Italy, as its new Chairman for the coming two years. Mr. Alf. E. Langsaeter (Norway) and Mr. K. Oedekoven (Germany) were also unanimously elected First and Second Vice-Chairman respectively, for the same term of office.

On behalf of all delegations, Mr. Camaiti congratulated the retiring Chairman, Sir Henry Beresford-Peirse, of the United Kingdom, on the excellent and most tactful way in which he had presided over the last two sessions of the Commission.

Equipment Section

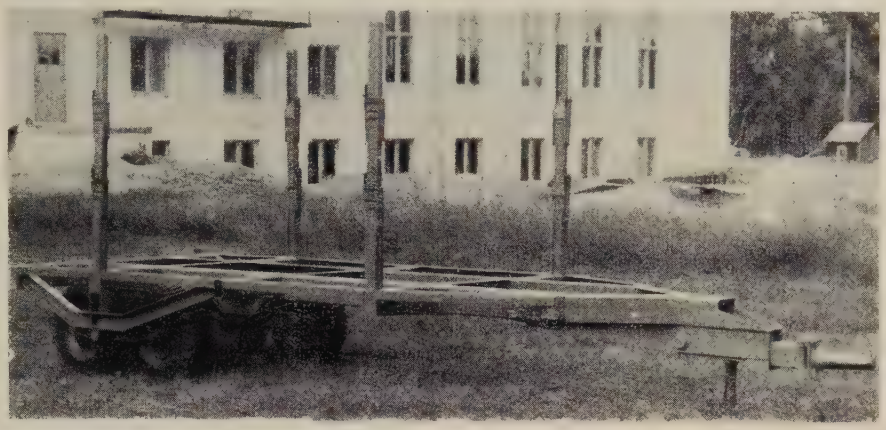
"Rossondoningen" Trailer. — Implement for timber haulage, for use with the Ferguson tractor. By means of coupling to tractor, part of weight of the load is transferred to tractor rear wheels. Special loading apparatus enables one man to mount or dismount unit in few minutes. Loader, mounted on either side of the trailer, consists of two guides directly fixed on the side pillars. Timber lifted by arms running in the guides.

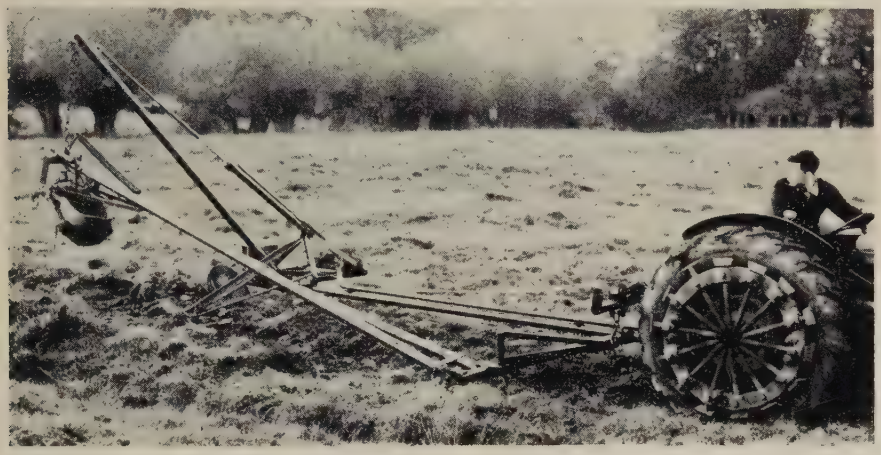
Specifications: Total length of load frame, 4 m.; total height with bogie, 74 cm.; total height with runners, 54 cm.; total width of load frame, 2 m.; wheel track, 1.4 m.; loading capacity with bogie, 6 tons; loading capácity with runners, 8 tons; lifting capacity, 1,000 kg.

Massey-Harris-Ferguson Export AS, Hovedvejen 183, Glostrup, Denmark.

Little Woodsman Chain Saw Filer. — Developed primarily for logger and woodsman working far out in forest where heavy and expensive saw sharpening equipment is not available. In light weight aluminium alloy. Small, separates into two pieces and can be carried in small tool kit or pocket.

Empire Industries Co., Inc., Lewiston, Idaho, U.S.A.

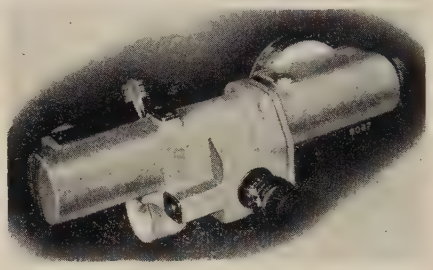




"Sapper" Ditcher. — Designed for use with heavier type wheeled tractors. Attachment by drawbar, 3-point linkage and one hydraulic coupling. Works progressively along ditch, no reversing or driving away necessary to dump soil, which can be deposited from 1-9 ft. (0.30-2.74 m.) from center of ditch. In normal conditions, the machine works at average 90 yards (82 m.) per hour. Max. depth 6 ft. (1.83 m.).

Machine can be assembled both right and left handed. Time taken to change machine from one hand to other is approx. 30 min.

Bomford and Evershed, Ltd., Salford Priors, Evesham, Worcestershire, England.



Barr and Stroud Dendrometer type F. P. 9. — Used in conjunction with tables supplied, to obtain widths of treetrunks at various heights, and values of these heights, to determine volume of trunks.

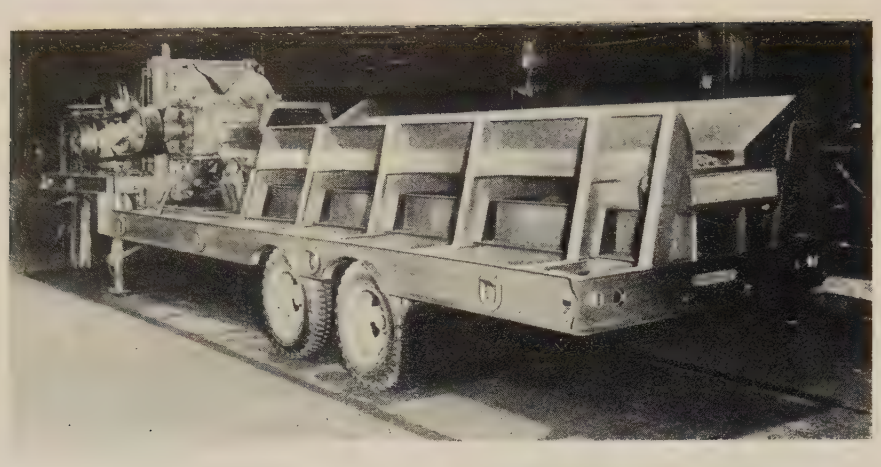
Specifications: Base length, 8 in. (20 cm.); magnification, 5.5X; type of field, coincidence, with both images erect; angular field, 7° vertical, 4°55' horizontal.

Barr and Stroud, Ltd., Anniesland, Glasgow, W. 3., Scotland.

Adams Motor Grader 660. — Adams Motor Grader 660 with 190 hp Cummins or General Motors diesel engine, features torque converter, Adams Constant-mesh transmission with power clutch for forward to reverse without shifting, four speeds forward to 27.4 mph. (44.1 kmph), four reverse to 24.4 mph. (39.3 kmph).

Specifications: length, overall 26 ft. 4 in. (8.03 m.); width, overall 7 ft. 10 in. (2.39 m.); height, overall, with cab 10 ft. 8 in. (3.25 m.); height, without cab 8 ft. (2.44 m.); blade, lift for ground clearance 19 in. (48 cm.).

Le Tourneau - Westinghouse Company, Peoria, Illinois, U.S.A.



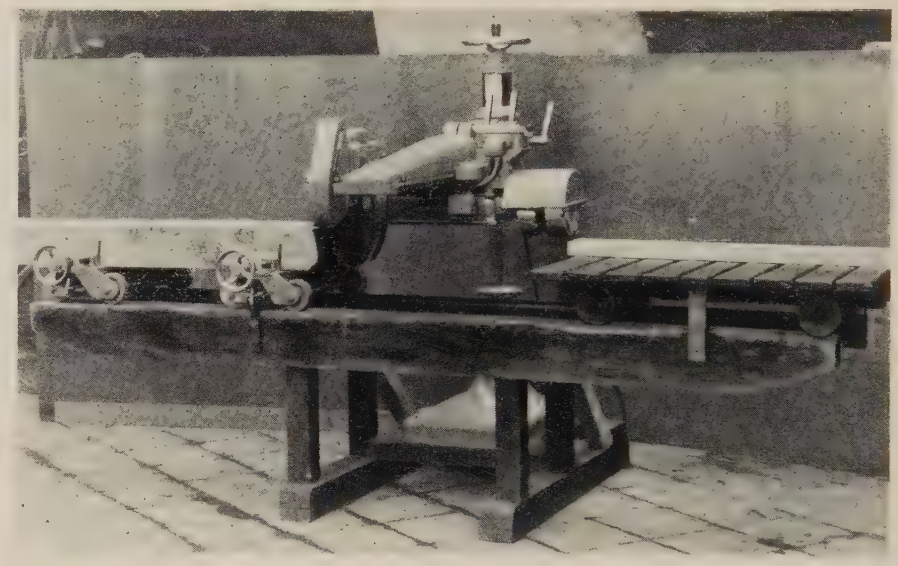
Sumner Portable Chipping Plant. — Complete chipping plant powered by diesel engine and mounted on trailer for portability. Entire plant is 8 ft. (2.44 m.) wide, 34 ft. (10.36 m.) long and weighs approximately 40,500 lb. (18,370 kg.).

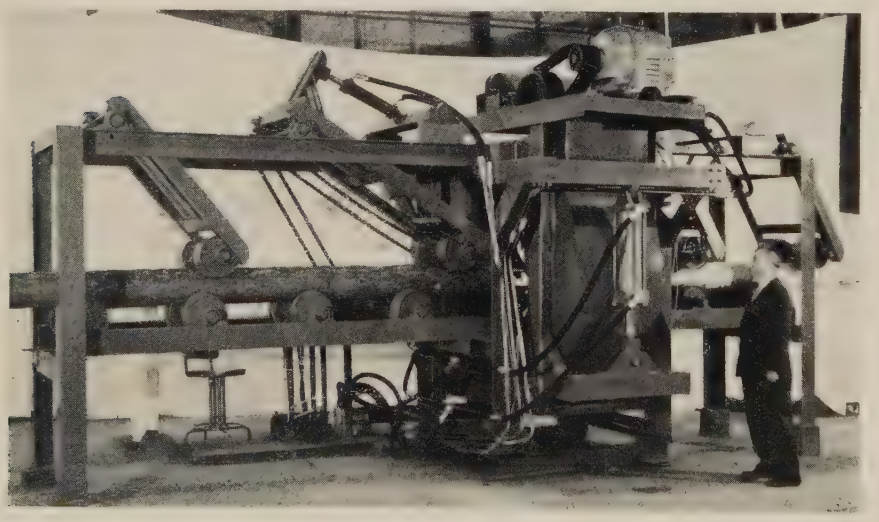
This unit is designed to produce chips from logs up to 16 in. (41 cm.) in diameter and 20 ft. (6.10 m.) long.

Sumner Iron Works, Everett, Washington, U.S.A.

Cross-Cut Saw. — "Festo" Parallel saw supplied as stationary and travelling type. Both models swivel round column in all directions. There are scales all round. Vertical adjustment up to 140 mm. by upper hand wheel. Motor, normally 4 hp, supplied for 3-phase current. Performs all oblique cuts customary in carpentry workshops, building enterprises, wagon and coach factories, joineries, etc. Nett weight of motor: 53 kg.

Festo-Maschinenfabrik G. Stoll, Esslingen a. N., Germany.

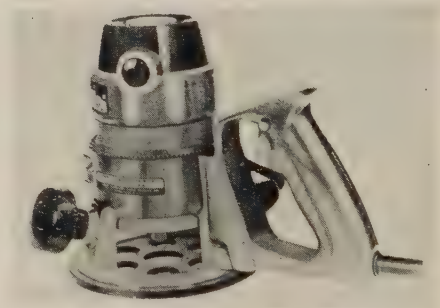




Mullis Log Skinner. — Takes any size log up to 30 in. (76 cm.) in diameter and any length log from 8 to 20 ft. (2.44 to 6.10 m.). Can be equipped with extra idle rollers to take logs 50 ft. (15.24 m.) long.

Adjustable center section, housing skinning arms, hydraulically raised or lowered to accommodate logs up to 30 in. (76 cm.) diam. Handles logs of any size or shape. Center section includes metal tank 10 ft. (3.05 m.) diam. (air reservoir) which prevents air from escaping rapidly. Tank, filled two or three times daily, stores air from 60 to 125 lb. (4.2 to 8,75 kg.) pressure per cm². Pistons extend from tank to steel reel containing 4 adjustable arms which the pistons power. Arms revolve around logs at speeds from 100 to 200 revolutions and skin off the bark.

Carl W. Mullis Engineering and Manufacturing Co., Inc., Lancaster, Southern Carolina, U.S.A.



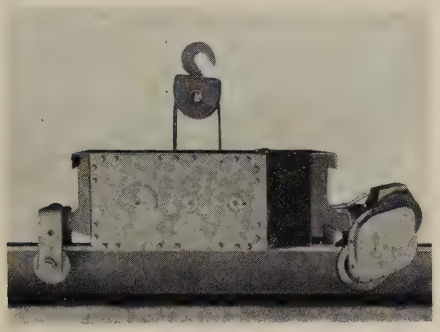
Router Model 150. — Features trigger-switch power control, and power unit interchangeable with planing attachment and shaper table. Can be used for veining, fluting, compound molding, reeding, beveling or V-grooving.

Specifications: 8 amp, $1\frac{1}{4}$ motor spins at 22,000 rpm, virtually eliminating burring and chipping even on plastic laminated surfaces; high-speed operation reduces need for finish sanding. Weight: $7\frac{3}{4}$ lb. (3.5 kg.).

Williams and Jensen International, Porter-Cable Export Department, South Haven, Michigan, U.S.A.

LETOURNEAU HOIST. — New hoist line requires 37 percent less headroom and offers precision load control to within 0.008 inch. (0.2 mm.). Load block shown extended in photo of 6-ton unit. In operation it can retract into U-shaped area between motor, gear-box and drum for maximum height lifts. Available in capacities from 3 to 15 tons.

R. G. LeTourneau, Inc. 2399 South MacArthur, Longview, Texas, U.S.A.



EXPAND-A-VAN. — Electrically and hydraulically operated. Double expanding sides. Steel and aluminium construction with approx. 80 percent of overall weight in aluminium sheets, forgings, extrusions and castings.

Specifications: Area when open, 30 × 26 × 7½ ft. (9.1 × 7.9 × 2.3 m.), when closed 7 ft. 2 in. × 26 × 7½ ft. (2.2 × 7.9 × 2.3 m.). Total weight approx. 25,000 lb. (11,340 kg.) of which approx. 40 percent on front bolster and 60 percent on rear axle. Double rear axles with bogie available. Total length of unit 35 ft. (10.7 m.). Heating and air-conditioning (optional) installed in front compartment of trailer, also electrical generator for hydraulic pumps and lighting.

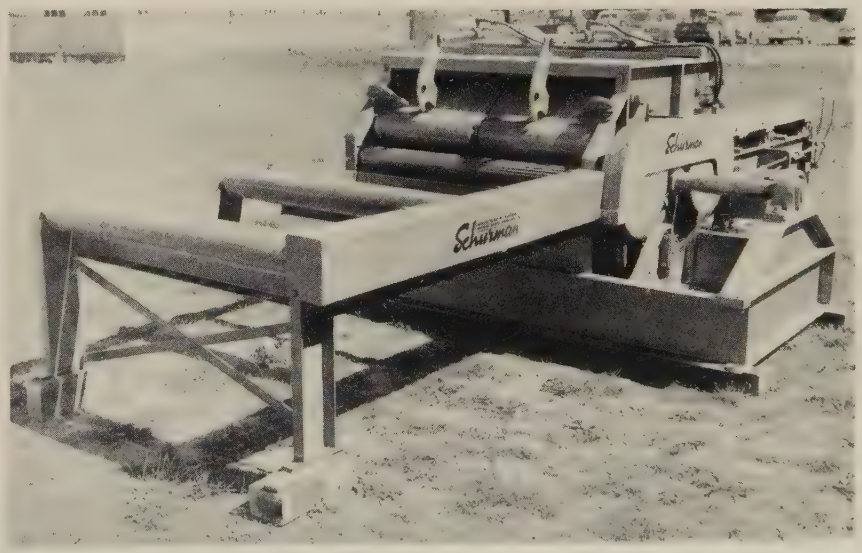
The Gerstenlager Co. Wooster, Ohio, U.S.A.

PLANER. — For automatic hand planing, can be used as independent unit in connection with jointers of any make, works material up to width of 610 mm. and height of 100 mm. Conveyor equipped with closely spaced grippers, with built-in 2-speed 2-hp squirrel-cage motor, 1500/3000 rpm, 3-phase A. C., 220/380 volts, with attached switch.

Adolf Aldinger Holzbearbeitungs-Maschinenfabrik, Stuttgart-Obertürkheim, Postfach 65, Germany.

SPLIT ROLL GANG EDGER. — Split roll gang edger produced in four sizes saws up to 12 in. (30.5 cm.) thick cants. No shifting saws but a number of saws in a cluster or gang on each side of the edger spaced at whatever spacing is desired. 6 in. × 48 in. (15.2 × 122 cm.) edger with both infeed and outfeed tables and hydraulic lift on the press rolls.

Schurman Machine Works, Inc., Woodland, Washington, U.S.A.



GOLDEN BEAR DUST-BINDER. — Stable emulsion consisting of approximately 60 percent semi-liquid petroleum resins and 40 percent wetting solution. Can be stored almost indefinitely.

When sprayed on dusty ground, dust particles become coated with thin film of petroleum resin, acting as an adhesive, binding individual small particles together. Dust is immobilized. For best applications, spraying under approximately 40-60 lb. pressure is recommended.

Golden Bear Oil Co., 325 West Eighth Street, Los Angeles 14, California, U.S.A.

FAO accepts no responsibility for the claims of manufacturers

News of the World

Australia

• An Australian expert, L. D. Pryor, while working on a field assignment for FAO in Iraq, noted that some valuable Eucalypt species, all belonging to the systematic group *Renantherae*, grew weakly and in many cases became chlorotic and often died in the nursery soon after the second or third pair of leaves had been produced. It was thought at the time that the highly calcareous soils characteristic of much of Iraq may have contributed to the trouble. The view that chlorosis and poor growth or even death might be caused perhaps indirectly by excess of lime had some support in the evidence of *E. camaldulensis*. This species is the most commonly planted Eucalypt throughout the Mediterranean and Middle East. It thrives in many localities but it is noticeable that, while tolerating some degree of lime, in the highly calcareous soils of Iraq, Israel, Jordan and Morocco it becomes at times chlorotic and fails. Recent work in Israel suggests that chlorosis can be corrected by a suitable iron injection and that the chlorosis is caused by a lime-induced iron deficiency.

In Cyprus, Chapman records 21 species of the *Renantherae* and 19 species of the *Macrantherae* (*Normales*) as having been introduced as seed, between 1878 and 1934, as well as species from other groups. It is true that in Cyprus, where Eucalypts have been required, the rainfall is low; nevertheless, five species of the *Macrantherae* (*Normales*) group (out of the 19 recorded as being introduced) are found growing on the island, but not one single specimen of the *Renantherae*, although eleven of the 21 introduced might have been considered likely to succeed from the general point of view of climate and soil.

Further results from trials by Monager (1953) who has planted Eucalypts in Les Landes, France, are interesting in this connection. As a result of his trials over four or five years he notes that the best species are *E. gunnii; E. macarthuri; E. subcrenulata; E. rubida; E. dalrympleana; E. viminalis; E. stellulata; E. parvifolia; E. bicostata;* and *E. camaldulensis;* whereas perhaps the most valuable ones *E. gigantea; E. obliqua; E. regnans; E. andreana; E. robertsonii* and *E. pauciflora*, have disappeared. It is striking that of these two groups the first belong to the *Macrantherae* with one exception (*E. stellulata*) and the second group belong entirely to the *Renantherae*.

On return to Australia, Pryor grew species of the *Renantherae* and *Macrantherae* in sterile soil. Under these conditions the *Renantherae* species developed the same chlorotic conditions observed in Iraq, while the *Macrantherae* did not show such symptoms. Highly chlorotic seedlings transferred from the sterilized soil to non-sterile soil regained their vigor, while those not transferred finally died. Examination showed the roots from the sterile soil to have no trace of fungal hyphae whereas those in the unsterilized soil showed a thin investiture of fungal hyphae.

This work was followed with various other investigations, among which was a trial of growing *Renantherae* and *Macrantherae* species in sterile soil inoculated with the spores of a *Scleroderma*. Chlorosis did not develop in the inoculated pots and microscopic examination showed a thick hyphal mantle. The untreated pots of *Renantherae* showed general discoloration and unthrifty growth.

Pryor suggests that a retrial of all the *Renantherae* species of outstanding importance as timber producers in Australia, is justified in areas where they have previously failed but where from considerations of climate and soil they might otherwise have been expected to succeed. Retrials to be made with the addition of *Scleroderma* spores from Australia to the potting soil overseas. Most of the chief timber producing Eucalypts of Eastern Australia are *Renantherae* species.

Austria

• An expert commission has proposed a long-range plan for the replanting of 135,000 hectares of mountain forest as a safeguard against avalanches. Inquiries in the province of Tyrol have shown that in the inhabited areas alone there are about 2,000 recorded avalanche paths. In recent years, two thirds of these have fallen across deforested slopes.

A report to FAO says that current afforestation of catchment areas and mountain pastures above the timber line has shown that knowledge with respect to growth conditions of forest plants in high mountainous districts is most inadequate. A research institute has been established in the Tyrol, which includes a department of climatic biology and a department of mycology, the former on the Patscherkofel mountain near Innsbruck (altitude 2,248 meters), and the latter located at Imst, Tyrol, with a field station at Obergurgl. The practical research work done there aims at facilitating afforestation work, making it feasible in a more economical way and ensuring greater success.

By artificial methods in specially air-conditioned environment and with the help of the most recent equipment, it is planned to bring about a drastic reduction in the time of experiments, to study the various influences on forest plants in high mountainous regions, and to derive special methods of planting and soil treatment from the knowledge thus gained.

Methods have been developed of inoculating nursery beds for conifers with mycorrhiza and these methods have proved suitable for afforestation at high altitudes. The degree of resistance of the young plants during their first years of growth is being greatly increased. The results obtained have been indeed amazing, as shown by a comparison made between the nursery beds that have been, or have not been inoculated.

Cameroons

• A report to the United Nations describes the forests in the northern part of the British Trust Territory as being of two main types, closed High Forest Outliers and open Savanna Woodland. The forest is the source of large constructional timbers whereas, in general, the savanna woodland consists of a continuous grass cover with small, usually malformed, trees set among it. Of great local importance for the provision of fuel, simple native building materials and thatching grass, this savanna woodland has a wider economic importance in that it provides large areas of grazing lands. Remoteness and absence of communications have prevented even the closed high forest outliers from being exploited other than for purely local purposes.

From time immemorial the forests of both types have been used by the native inhabitants for the provision of firewood, simple building materials and minor forest products for food, medicines and other domestic purposes. Though the ancient use of the forest for the construction of dwellings lay chiefly in the provision of simple poles, as a framework for mud walls, and the raphia palm for rafters and roofing mats, yet another use of the forests for timber was in the making of hollowed out trunks for dug-out canoes.

The forests also played, and still play, an important role as the source of considerable quantities of animal protein. They provided also the fertile soil necessary for the growth of food crops, areas round villages being periodically felled, burnt and farmed for a short while.

As the farms became worked out, fresh areas were farmed and the old allowed to revert to forest fallow. As villages themselves not infrequently moved to fresh localities, the effect upon the vegetation was vast and it is doubtful whether to-day any forest which is more than a century old or so could be found except upon the most inaccessible hilltops.

Such has been the practice for many years and the picture is, even to-day, hardly altered. It has not been possible, owing to the shortage of professional staff, to spare the full-time services of a forest officer solely for the northern part of the Trust Territory, and consequently it has not yet been possible to constitute any forest reserves. Recommendations for the reservation of two areas of high forest, totalling approximately 41,600 acres (16,800 hectares), have been accepted.

Over 19,000 acres (7,770 hectares) of savanna woodland have been declared as Communal Forest Areas.

No concessions have been granted for the development of timber or other forest industries so that it is not possible to forecast the attitude which the indigenous inhabitants would take, but there is reason to believe that it would not be unfavorable. Similarly, it is not expected that there will be any real opposition to the creation of forest reserves or communal forest areas.

In the Southern Cameroons, some districts are forest country; the rest of the territory is generally quite well wooded but in parts, such as the Bamenda highlands, timber is very scarce. The woodlands provide fuel and building poles, the forests timber for bridging and other heavy construction, and for export. In addition, some trees have medicinal properties, some, like the calabash, provide utensils, and the raphia palm affords roofing material. Many houses are walled with planks from the pycnanthus kombo, a soft wood, locally called karraboard. Canoes are made from hollowed-out trunks, though light wood is required for paddles. The long canes from climbing palms make hammock bridges, while other forest plants yield basket withies, fibres for matting, and resins, gums, and spices.

Because of the improvident farming methods already described, there is little if any forest in the territory more than a century old. Timber exports began under German rule, one of the most highly valued being ebony. In the Southern Cameroons, there are 1,454,000 acres (588,400 hectares) of forest reserve.

Canada

• Projected development on a large scale of timber, mineral and hydro-electric resources in northern British Columbia has been reported in the press.

An "agreement of intent" has been entered into with Swedish interests, and the project may eventually entail considerable investments, particularly for the construction of a high-speed railway of a unique design. Secondary developments deal with utilization of the forest resources on a sustained yield basis, extraction of minerals and extensive hydro-electric installations.

Contracts have already been signed for surveys covering not only the railway alignment, but also forest inventory and mineral discovery. Outstanding specialists in each field from Sweden, the United Kingdom and Canada have been engaged.

On the other side of Canada, in Newfoundland, all pulpwood can — and most does — travel to its mill by water, either coastwise by barges tugged for anything up to 36 hours or riverwise according to the speed of the current and the appetite of the mill.

The men concerned in the operations are not so well served with means of transportation as their logs. Though since 1949 the Provincial Government has been spending large sums on expanding the road system, it so happens that much of the forest now being cut over or scheduled for cutting soon is without those means of transportation which well-paid men expect.

It is perhaps fortunate that almost all the men in question are accustomed to isolation and know far better than most Canadians how not to be frustrated by the simple life. They are fishermen and sons of fishermen from the outports, and it is amazing how quickly a Newfoundland fisherman becomes a woodsman. And a woodsman in those northern forests is not only a feller of trees. He takes to anything from cost accountancy at the depot to handling a gigantic tracklaying bulldozer. Everything that can be done by machine is done by machine. Output per man-hour is the prime consideration, and the trees tumble with formidable speed. Two interesting developments have recently come about from this feverish sense of urgency: the power saw and the insect repellent. The former is estimated to increase the cutter's output by one third and the latter to keep him in the woods when otherwise he would not go near them.

Cyprus

• The Forestry College in Cyprus completed its fifth academic year in 1956 with 36 students, of whom 35 secured their certificates. Up to date, 90 students have completed their training; 58 of them have returned to posts in Cyprus and 32 foreign students to key posts in the Forest Services of Iraq, Jordan, Syria, Libya, British Somaliland, British Honduras and the British West Indies. For the sixth academic year, which started in October 1956, the student registration comprised: 20 Cypriots, 3 Libyans, 4 Iraqis, 2 Iranians, 2 Lebanese, 1 Somali and 1 from British Honduras, all of whom are taking a two-year course to forest ranger level.

Denmark

• During the last decade the stock of deer in Denmark has increased considerably as has been the case in most Northern and Central European countries, and the damage, particularly that caused by red deer, has raised a growing anxiety among foresters and farmers. To tackle the problem and to find, if possible, a sound and proper equilibrium between productive interests and wild life conservation, the Ministry of Agriculture has set up a widlife commission with particular regard to deer. In collaboration with the Danish Game Biology Station, this commission is now compiling data and initiating investigations to acquire a better knowledge of the biology of the deer and of possible management measures to protect forest and agricultural crops.

El Salvador

• A good example of international co-operation in regard to the utilization and protection of a natural resource is reported by the FAO Regional Forestry Officer for Latin America.

In 1950, El Salvador began the construction of a hydroelectric station on the Lempa river. The initial output of this station, 30,000 kilowatts, was later raised to 45,000 kilowatts. The plan since has been to bring output up to 75,000 kilowatts, but this further increase could only be obtained by drawing on the waters of the frontier Lake Güija, two thirds of which lie in El Salvador and one third in Guatemala.

Negotiations between the countries were recently brought to a successful conclusion. El Salvador has agreed to supply a certain amount of electric power to Guatemala, while Guatemala in turn has agreed to take all the necessary protective measures — particularly forest protection — to prevent any silting up of Lake Güija as a result of erosion of the mountain slopes encircling the lake.

Finland

• A report to FAO states that, last year, two enterprises exporting prefabricated wooden houses united into one organization which began its activities at the beginning of February 1957.

The Finnish, Norwegian and Swedish newsprint producers have established in London a common sales organization for the United Kingdom.

A number of sulphite pulp industries have established a joint company for the marketing of sulphite alcohol, which started functioning at the beginning of July last year.

France

• The *Annuaire général du commerce et des industries du bois, France Bois*, 1957, contains full information with regard to:

> Public services and professional organizations the wood-working industries classified by specialized field
>
> French constructors of equipment for all the various trades concerned with wood
>
> A geographical and alphabetical classification of forest enterprises and sawmills.

This directory is of the greatest use to all those who have dealings with the French timber industries and trade.

• New trains of a revolutionary design are in use on one of the *Régie autonome des Transports parisiens* underground lines. The tired vehicles do not travel on steel rails but on wooden tracks of *Azobe* from the Cameroons. The advantages claimed for these trains are speed, light weight, big transport capacity, extremely smooth running, and that they are practically noiseless. Long investigations proved that wood alone gave entire satisfaction: negligible wear, even after 200,000 kilometers, perfect electric insulation, easy assembly and low cost.

Germany, Federal Republic

• Determined efforts are being made, it is reported, to keep timber fellers at work all through the year. This is especially important in the case of trained specialists, because with the present full employment in the economy, there is always the danger that loggers will quit their work and join industry. A fair distribution of work throughout the year is more difficult in hardwood regions where fellings are limited to the winter period, while in softwood forests logging operations may be carried on also in summer time. So far, some success has been reached in hardwood forests by concentrating road building and other work into the summer months.

Investigations on the planning and organization of all types of forest work have been carried out in Baden-Württemberg. The whole work load of a district has been analysed and correlated to the existing manpower, and the administration has been enabled in this way to guarantee full employment by appropriate planning and to do away with disproportions which were so common previously.

To keep loggers in their jobs, it is most important to facilitate their work and to diminish their physical exertions, as all experience proves that manpower flows to lighter work. The steady training of forest workers in schools and in the forests in connection with the introduction of better tools and equipment, has already resulted in a marked increase in productivity. Living conditions of forest workers have greatly improved.

The shortage of young apprentices and the heavy proportion of older age-classes are still a danger. In 1956, 107, 259 forest workers were employed in German forests against 125,336 in 1955. But in spite of this decrease, the planned program was accomplished owing to intensified mechanization and rational work schedules.

ETHIOPIA: *This photograph by an FAO officer shows how the capital, Addis Ababa (middle distance) is surrounded by artificially created forests of* Eucalyptus globulus.

Israel

• The development of wood preserving processes and the utilization of chemicals locally available have stimulated the full and integrated utilization of homegrown timber. Telephone and electric poles, durable grape stakes, fence posts and banana supports are now available and result in a tremendous saving on forest drain. Prior to this development work, posts of all kinds for agricultural use required replacement every one to three years. Treated material should now last 15 to 20 years.

Factories have been established to utilize various waste materials for the production of wallboard, hardboard and chipboard. Small bolts are also being utilized for the production of excelsior to be used with cement to form building blocks.

New Zealand

• During the financial year which ended on 31 March, New Zealand Forest Products Limited is claimed to have contributed the equivalent of U.S. $16.8 million to the country's balance of payments through export earnings and import savings. Exports reached nearly U. S. $5.6 million, while local sales of pulp and paper products are said to have saved over U.S. $11.2 million for imports.

Most of the exports were made to Australia and represented one quarter of New Zealand's total exports to that country. Pulp was also sold to Great Britain, South Africa, India and Japan.

The Company also remained the largest exporter of timber, and sold a small quantity of wallboard and paper overseas.

During the year 1957-58, production of pulp is expected to reach 65,000 tons. A bleaching plant is being installed to produce a greater variety of pulps and papers. The capacity of the kraft paper machine is also being extended.

Nigeria

• Correct silvicultural treatment of tropical forests depends to high degree on the knowledge or lack of knowledge of the operators and forest workers. In Nigeria, sample plots are maintained to check the damage caused to saplings and poles of commercially valuable species during operations under the Tropical Shelterwood System.

The two main types of damage, caused mainly by ignorance, are the cutting back of saplings of valuable species, and the poisoning of poles of valuable species. Poisoning operations are regarded as normal treatment as a means of destroying shade-casting uneconomic trees of the middle and lower stories in the tropical forest, but the operation frequently results in loss of valuable trees. Cutting back results in loss of height growth and in pollarding which may result in the lower bole being misshapen.

India: *An FAO Technical Assistance officer on assignment in India sent this photograph of land slips in the Siwalik Mountains which have contributed to the heavy siltation of streams. The slip on the right is healing through the natural invasion of scrub vegetation while control of the slip on the left is being attempted by the use of brush wood revetments. Abusive land use, especially grazing, is partially the cause of such conditions.*

Panama

• A prominent article in a national newspaper pleads for greater consideration to be given to the conservation and development of the forest resources of Panama.

Plans are progressing and work is being done on building and improving the highways in and adjacent to the Republic of Panama. The new highways will open up timber land which has not been accessible from present highways or from the rivers and coast.

Indiscriminate logging and clearing can have various bad effects. The most obvious is that valuable trees are used up without replacing them, thus depleting natural resources of the nation. Also serious is that, when the trees are removed, the heavy rains may carry away the soil and ruin the land. In extreme cases the land may become so eroded by gullies that it can never be reclaimed for any useful purpose.

Timber industries, properly directly and operated, can contribute enormously to the economy of the country. The old concept of logging the forests mostly to export mahogany and a few of the other popular tropical woods, or having a sawmill to make lumber from just one or a very few kinds of trees, is giving way to more scientific ideas of diversified wood industries that use a variety of trees and give employment to many people, at the same time furnishing items needed by the country, as well as for export.

Apart from the export of logs and production of boards for local use or export, other wood industries of present or potential value include: the cutting of fence posts, railroad ties, firewood, telephone and telegraph poles, piling for construction of docks and wharfs, and the manufacture of veneers, plywood, fibreboard, chipboard, charcoal, pulp and paper products, furniture, toys and novelties, boxes, crates, baskets and prefabricated houses or individual parts such as door frames and window frames.

It is easy to discuss new concepts and large industries, but in practice there are difficulties in any tropical logging and lumbering operations. One of the problems is capital, especially for an industry sufficiently complex to take full advantage of all the available species of trees.

Another problem may be labor supply, especially of skilled technicians. Transportation is another one; shipping or floating logs by water is usually cheaper than trucking.

In the establishment of huge industries there may be a danger of squeezing out the little man, who is so important in the overall economy of the country. The ideal situation would be to have large industries and small operations, too. The latter should at least include tree farming or logging and lumbering by individuals and small companies.

The present and contemplated expansion of the country's highway system will open up more forest areas, increasing the necessity and urgency for good planning, legislation and action both to conserve natural resources and to develop industries based on these natural resources.

Sweden

• A report to the European Forestry Commission states that official testing of forest machines has started. Reports on the testing of a number of power saws have been published by the State Agriculture Machinery Testing Center, Ultuna.

During recent years intensive research work has been carried out to increase the employment of the 120,000 agricultural wheel tractors in forestry. The ability of wheel tractors to operate in pathless terrain and in deep snow has been improved with various semi-track devices. One problem has been to produce a suitable timber transport trailer which can be attached to wheel tractors. A construction competition was arranged and was successful.

The large-scale forestry operations in Northern Sweden have shown, however, that the mechanical draft-power in forest operations ought to consist of specially designed crawler-tractors. Good results have been attained when using small crawlers where the conventional stiff track body has been changed for a new bogie-construction with a more flexible spring system. This arrangement means better ability of the tractor to operate in deep snow and also many advantages when driving on bare ground.

Research with forest tractors is also a part of the intensified experiments with timber transport in deep snow. In large parts of the country, the main logging operations are still restricted to the winter. Deep snow — which is normal in Northern Sweden — is then an aggravating factor for the fellers as well as for the haulers. Among other things it means great costs to plow and maintain skidding tracks and hauling roads. The " compact snow " road has proved to be a rational method. It is built up by packing the loose snow, using tractors or special machines. The packing of the snow changes its structure and this gives a solid foundation for a road. A good compact snow road can carry truck traffic.

Owing to the climate and to transport conditions, a great deal of the timber has to be debarked for storing in the forest for a short or long time. As manual debarking amounts to half of the work in cutting timber, mechanized debarking has attracted much attention in the rationalization efforts of Swedish forestry. The main difficulty is to combine the qualities of reliability and capacity in a transportable machine.

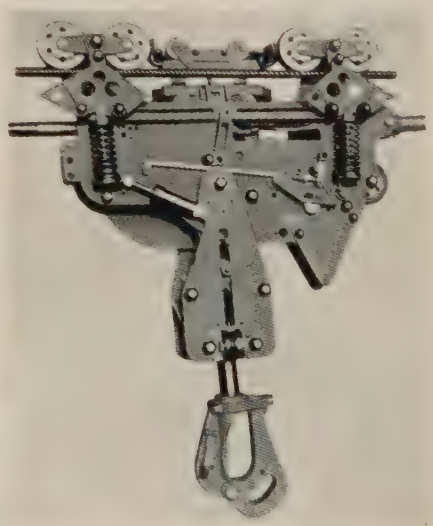
In 1955, a Swedish type appeared which gave solution to some of the technical as well as economical debarking problems. As forest industries are also investing money in permanent debarking drums and other machines of high efficiency, it can be foreseen that manual debarking will decrease rapidly in a few years.

Turkey

• Higher education in forestry is provided by the Faculty of Forestry, University of Istanbul, which began in 1857. Professors of this faculty are exchanged with the professors of German universities. The teaching staff consists of 11 professors, 9 associate professors and 23 assistants.

SWITZERLAND: *A completely new type of Wyssen Skyline crane (for details see picture on right) can now carry 5 ton loads over a distance of 1,200 yards (1,000 meters) on a single cable. A larger winch is at present in production which will increase the haulage length to over a mile. The new automatic carriage eliminates the use of the sliding 'stop' along the main cable which was essential on former lighter models, and this greatly increases the output. Logs from a strip of forest 400 feet (122 meters) wide and nearly one mile (1.5 kilometers) long can now be collected from the ground and delivered at the unloading terminal at the rate of about 20 tons per hour, with a crew of five men.*

The Skyline crane is also used for transporting heavy water-pipes or constructional materials over difficult terrain.



The number of students is 580 for the year 1956-57.

The faculty has an experimental forest and a nursery of its own. In addition, the students continue their practical field work under their professors in three modern forest enterprises of the General-Directorate of Forests.

The subordinate forestry personnel are trained in the schools run by the General Directorate of Forests. At present, there is a school in Düzce for training in practical forestry work, and one for forest guards in Araç.

The school in Düzce enrols students from secondary public schools. The period of education is three years, and in each academic year the students are given theoretical courses in forestry for seven months and practical forest training for three months. The graduates of this school do technical field work under the District Rangers. At present, the school has 11 teachers and 135 students.

The training courses at the school for forest guards in Araç last for a year. Young villagers who have completed their primary education and their military service are given priority for acceptance at the school. The students are given both theoretical and practical courses in forest conservation and improvement.

United Kingdom

• Reference is made earlier in this issue to a report by the Natural Resources Committee on *Forestry, Agriculture and Marginal Land.*

A summary of the conclusions of this report reads as follows:

The present report summarizes the results of an extensive study of the problems involved in increasing the use of indigenous sources of timber, and of the repercussions of afforestation on the agricultural use of marginal land.

During the 1939-45 war, the main goal of agriculture policy was the maximum output of milk and of crops for direct human consumption. The emphasis of the postwar expansion program has shifted in recent years to the production of livestock. The hill and upland livestock rearing areas are of vital importance to this policy, of which the general aim is to achieve the greatest economic production possible.

It has long been customary to import most of the timber used, but shortages in two world wars have emphasized the need for domestic supplies. The Forestry Commission were therefore charged in 1945 with a fifty-year planting program designed to supply essential requirements of timber in emergencies. Strategic considerations have changed since then but, on the other hand, there is a greater economic reason now for investment in the planting of trees.

The upland districts of the United Kingdom are already sparsely populated, and the trend is towards further depopulation. Soil fertility in these areas is generally low, and in some districts is progressively deteriorating. In view of the ever-recurring threat of trading difficulties, one cannot view with equanimity the under-use, amounting in places to abandonment, of much marginal land made up of rough grazings and waste lands. These categories of land, extending over 20 million acres, constitute almost two fifths of the land surface.

Various surveys of rough grazing and marginal land have shown that the productivity of some 4 million acres could readily be improved, and that much of this land could be dealt with at less than £30 per acre. These acres play an essential part in domestic meat production as a breeding and rearing ground for cattle and sheep, and their depopulation is a source of increasing anxiety. Population and agricultural production can be maintained only by more capital investment, but the development of agriculture will not, by itself, be sufficient to correct the situation.

Although physical conditions in the United Kingdom are more favorable to the growth of trees than in many European countries, the proportion of the land surface of the United Kingdom which is under forest is less than in any other Western European country. Even so, much of the land classified as woodland is at present unproductive. The planting program of the Forestry Commission is, however, being delayed by the difficulty of acquiring suitable land. It is estimated that more than 4 million acres of rough grazing are suitable for afforestation. Much of this land is on livestock hill farms, but areas of coppice and commons provide opportunities for forestry.

Comparisons between the financial returns of agriculture and forestry are difficult, because of the great difference in the length of their production cycles. Studies by the Committee of a number of selected areas in the United Kingdom suggest that, on marginal upland areas, forestry may have a slight advantage over agriculture in returns on invested capital. Although the assessment of the relative import-saving value of forestry and agriculture on such land is very difficult, in the long term, forestry would apparently show an advantage over agriculture.

Imports of wood and wood products cost at present about £430 millions per annum, including about £180 millions for saw timber. There is likely to be a continuing domestic demand for any sound commercial saw timber that can be produced, and even the Forestry Commission's full program of 5 million acres of productive forest would meet only one third of present requirements. The main problem is to dispose of the increasing quantity of thinnings. A substantial proportion will continue to be used for pit-props, and new factories are being erected for the manufacture of building board and chip board. Wood pulp for paper and for man-made fibres comprises a large part of imports of timber products. If certain technical difficulties were solved, there would appear to be scope for a substantial increase in the production of wood pulp for paper.

Other home sources of pulp for paper production are waste paper and surplus straw, but these are unlikely, in normal circumstances, to provide a greatly increased contribution to supplies of pulp. Commonwealth sources of pulp, particularly rayon pulp, are likely, however, to continue to be competitive with home-produced supplies. The further development of wood pulping plants in this country based on the use of home-produced timber will depend on the economics of relatively small-scale pulping units and on the encouragement given by the home timber industry and by appropriate Government Departments to the establishment of such factories.

A number of practical difficulties are hindering the Forestry Commission's planting program and the development of private woodlands. Lack of immediate financial advantage, the need for large capital investment, and the shortage of skilled forest workers make it improbable that private interests will engage in afforestation to any significant extent.

The program of the Forestry Commission is hampered by the difficulty of acquiring suitable land; by competition from other interests for the type of land required; by the need for extensive consultation before acquiring land; and in some areas by the hostility of local people to the idea of afforestation. If present conditions continue, it is unlikely that the rate of planting originally envisaged will be achieved.

A number of reports concerning particular areas in Scotland and Wales draw attention to the importance of forestry, when properly integrated with agriculture, as a means of strengthening the social and economic fabric of the countryside.

[1] £1 per acre = $7 per hectare.

UKRAINE: *This photograph taken during the FAO study tour organized last year in the U.S.S.R., shows cultivation work in a State forest shelterbelt at Belgorod on the River Don, Kharkov Region, Ukraine. The Ukraine S.S.R. has applied for membership in FAO.*

The Committee regard this as generally applicable to all similar land in the United Kingdom. Afforestation of the less fertile areas of such regions would provide shelter for livestock and supplies of timber for fencing, etc. It could also lead to economies in capital services such as roads and schools; to an increase in the rural community; and to the possibility of sharing heavy equipment between forestry and agriculture. Even though integration would involve higher costs of afforestation than the planting of trees in large compact areas, the advantages appear to outweigh the extra costs.

If proper integration is to be attained, the Forestry Commission and the Agricultural Departments would have to co-operate more closely in the future than they have in the past. A few farms might be used for the purpose of demonstrating the value of the policy of integration to the agricultural community. The Forestry Commission might also assist private owners by undertaking forestry development on an agency basis, with the possible assistance of government loans. Technical advice on the advantages of forestry should also be more readily available to landowners and farmers.

If the best use is to be made of marginal hill lands for forestry and agriculture, attention will have to be directed to the continuing existence of small and uneconomic farm units. The committee believe that the solution of this problem is closely related to the integrated use of marginal hill land for forestry and agriculture which they advocate.

• A large number of consumers of timber, merchants and growers make use of the facilities offered by the Forest Products Research Laboratory of the Department of Scientific and Industrial Research. During 1955 and 1956, more than 10,000 written enquiries were dealt with, in addition to many verbal enquiries. The advice sought and given covered a wide variety of subjects ranging from the manufacture of hardboard from tropical timber to the erosion of aluminium in contact with wood. As well as conducting fundamental research into the properties of wood, the laboratory undertakes seasoning, wood-working and strength tests both on imported hardwoods and on thinnings from British plantations.

Research continues at the laboratory to improve methods of working timber; the production of new types of machinery and the improvement of existing ones are carried out mainly by industry.

The use of home-grown mining timber has increased in the last two years. A private chipboard factory is operating in Dumfriesshire, Scotland, entirely on small coniferous thinnings. Work is proceeding on the building of a hardwood pulp mill in Monmouthshire, Wales; this mill, which is also being built by private enterprise, will provide a valuable outlet for small size silvicultural thinnings and some of the assortments of produce arising from the clearance of derelict hardwood coppice and scrub in South Wales and south west England.

In Wales, plans for integrating sawmilling with the production of mining timber and the manufacture of insulation board from waste have further advanced and a start made on the erection of the board mill. This also is a private venture.

United States of America

• The Fifth World Forestry Congress will be held in the United States of America in 1960. The Council of FAO agreed in June that a site in the Pacific Northwest — in Oregon or Washington State — will be the center of the meeting of foresters, representatives of forest industries, and experts in research and in the use of forest products.

Although FAO has no direct responsibility for the meetings, which began in 1926 under the auspices of the former International Institute of Agriculture, it has by custom played an important role in the organization and conduct of the congresses. The meetings are composed of individuals rather than of government representatives, and the responsibility for the technical and financial arrangements rests with the host country. Since FAO's formation, its Forestry Division has been made available to help the host country in planning the Congress, collecting background papers and seconding officers.

The leader of the U.S. delegation to the FAO Council in Madrid said the widespread interest of forestry people and the U.S. Department of Agriculture in the work of foresters all over the world, plus the greatly increased application of modern methods for management practices in the United States would make for the greatest exchange of benefits between host and guests. Washington and Oregon, he said, offer a wide variety of forest conditions and industries, as well as experimental stations, forests schools, nurseries, research installations, tree farms, national parks and other forest institutions.

A preparatory organizing committee has been set up to begin the work of arranging the Congress.

• Controlled burning as a silvicultural tool in the slash-longleaf pine type in the state of Florida has reached the stage in which its practice and its safe application can be standardized, according to the Florida Board of Forestry. The primary aims are to reduce fuels in the "roughs", to prepare ground for

natural seeding, and to control brown spot disease on young longleaf pine.

To prepare for burning it is necessary to plow firelines first at the leeward edge of the area to be burned, and then adding additional prepared lines paralleling the baseline and from 600 to 800 feet (180 to 240 meters) from it and each other. The area must, of course, be carefully selected, meaning the right size for the pines so that they will not be severely damaged. If good hardwoods are present, the area should not be burned, but undesirable hardwoods may be damaged or destroyed by the fires. The time to burn should be selected when there is a steady, moderate wind, and during the non-growing season, and preferably after a winter rain. The first fire is set progressively along the baseline of the leeward edge and, after it burns into the wind for 100 feet (30 meters) or so, fire can be set along the next line and so on until the entire area is covered in sections. Careful watching and patrol during the burning area is, of course, required along the baseline and the sidelines.

The general range of costs is from $0.10 to $0.30 per acre ($0.25 to $0.75 per hectare) but, particularly on smaller areas, it can go higher.

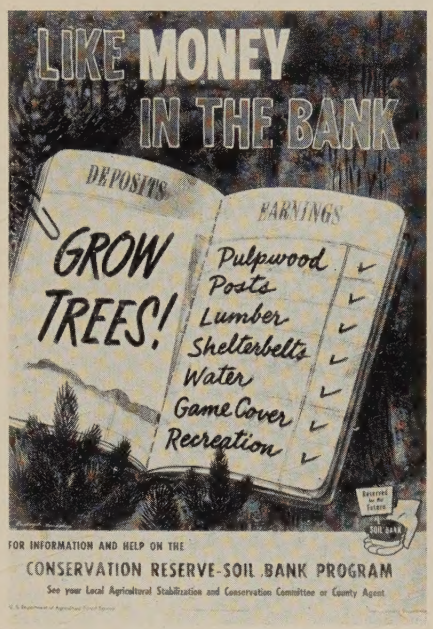
• One unforeseen problem of fighting forest fires in the inaccessible areas of the National Forests in the western United States has been the reconditioning of the kapok sleeping bags which have been traditionally provided for fire fighters.

The problem is reported to have been solved by providing paper sleeping bags which are durable enough to last during the usual fire campaign, and cheap enough so that they may then be abandoned. The bag is 6½ × 3¼ feet (2 × 1 meter), made of ¼-inch (0.62 centimeter) cellulose with two retaining layers of 40-pound (18 kilograms) creped and dry waxed kraft paper, with a protection flap of paper and draft curtain of soft cloth. The bag weighs 4 ½ pounds (2 kilograms). If used at high elevations or in early or late season, the bags may be cold, in which case additional paper blanket inserts are provided.

The only unsolved problem is that the paper bags rustle and are noisy!

• Most genetical work in the United States has concentrated on improving forest trees and stands in growth, tree form and other qualities or characteristics which may be determined by inspection and readily made measurements. Although it has been evident that the quality of the wood is, at least in major part, dependent on genetical factors, the techniques for determining these qualities have not until recently been developed.

Two years ago, the Forest Products Laboratory at Madison undertook a study from the genetical standpoint of wood quality of the southern pines, a group of species known to display wide variation in wood quality due to genetical factors. The new techniques have now been largely developed, and permit rapid, accurate determination on large numbers of small samples from living trees. One of these techniques is the maximum moisture method for determining specific gravity of aggregate or single annual rings in increment cores and very small samples of separated springwood and summerwood. Another involves use of fluorescent microscopy for measuring fibril annuals on standard increment cores.



United States of America: *This poster was issued by the Forest Service of the U.S. Department of Agriculture in connection with the Soil Bank Program mentioned in* Unasylva, *Volume 11, Number 2.*

Through these techniques, wood quality evaluations determine percentage of summerwood, fibril angle and wood density, all of which are strongly correlated with such quality factors as mechanical strength, shrinkage and pulp yields. Together they provide a reliable index to the suitability of wood for lumber, pulp or other common uses. By comparing the results with previously established relationships, a rating scale can be made which classifies trees as below average, average, above average or outstanding in intrinsic wood quality.

As methods are expanded to study the hardwoods, other properties will have to be taken into consideration. An interesting sidelight is that it has been found, accidentally, that curly grain in hybrid poplars is apparently a genetical quality, and this opens a wide range of future research to examine further the desired features of grain which are sought in fine cabinet woods. This particular poplar is now being tested through progeny tests.

Yugoslavia

• In order to enable fuller use to be made of mechanized equipment in forest operations and to make the forests generally more accessible, the policy of substantial investment in forest road construction was continued in 1956 and over 1,000 kilometers of roadway were built, states an official report to FAO.

Some of the large forest industrial plants, primarily those making plywood and fibreboard, have been remodeled and re-equipped to increase production capacity and efficiency.

The increased output of coal, electric power and combustible gas in the country has led to a sharp reduction in fuelwood consumption in the towns. Even in rural areas, the villagers have been induced to cut less wood for domestic fuel, making more timber available for industrial uses.

Book Notices

Forstlicher Strassen- und Wegebau (Forest Roads). F. Hafner. pp. 380, 1956. ***Planiergeraete im Forstlichen Strassen- und Wegebau*** (Heavy Equipment in Forest Road Construction). F. Hafner and W. Hedenigg. pp. 76. Georg Fromme and Co., Vienna-Munich 1956.

Since the end of the second world war, Austria has, partly with the help of international technical assistance, greatly increased her efforts to open up her forest resources by means of forest roads. Within one decade roughly 5,000 kilometers (over 3,000 miles) of new roads have been constructed, an achievement only made possible by modern, mechanized equipment.

The first of these two publications is an up-to-date, complete and well-illustrated textbook on forest roads primarily in mountain regions, dealing with the various aspects, possibilities and ways of planning, and the methods and types of construction. The basic theoretical considerations are discussed, with formulas and tables, as well as the practical experience acquired in the course of many years of road building in typical mountain country. Traditional methods of manual work are described with the same care as modern, highly mechanized equipment and methods.

The concept of forestry is that of the Central European alpine region, in as much as the book places great emphasis on very careful planning, layout, construction and subsequent maintenance of forest roads, which are intended for perpetual use under sustained yield management. Consequently, the periods for paying-off such roads can be very much longer than for forest roads in "cut out and get out" exploitations. This may explain why, in countries like Austria, a very good technical road standard often seems to take priority over considerations of costs alone and of short-term economy.

The second publication is a very interesting report on work and cost studies on various types and sizes of bulldozers, angledozers and motor graders used in forest road construction in the Austrian Alps in 1955/56. This is probably the first time in Central Europe that investigations into the suitability of highly mechanized road building methods for mountain forest roads have been carried out on a large scale, and the results are therefore of great interest. In particular, it has been found that heavy-duty equipment (70 to 100 hp.) is twice to three times as economical as lighter machine types, and that its application is not only much faster, but also four to five times cheaper than manual work.

Grundlagen der Chemie und chemischen Technologie des Holzes (Outline of Wood Chemistry and Chemical Wood Technology) W. Sandermann, pp. 498, ill. 221, tables 134. Ed.: Akademische Verlagsgesellschaft Geest and Portig K.-G., Leipzig (Germany), 1956.

In the preface the author states that the publication is mainly intended as a textbook for students but also that it should appeal to a wider range of people with an interest in wood as a raw material.

This assumption is well-founded, partly because of the actual contents of the book and partly because of the way the material is presented. Besides covering the fields of wood chemistry and chemical technology, the book also contains as an opening section an economic analysis of wood as a raw material. This section, numbering 77 pages, outlines the history of wood utilization, discusses the present situation, the competition with other raw materials, and presents forecasts of developments which are partly projected into a distant future. Most of the trends discussed will, however, make themselves strongly felt within the present generation. The destiny of the various branches of the wood consuming industries is elaborated upon, and such threats as the fully synthetic fibres and glass fibres for textiles and paper are considered. Finally, the development of forestry in view of the important functions of forests aside from that of supplying wood are mentioned, and on this basis conclusions drawn with regard to the future of the wood industries.

After short sections on photosynthesis and wood anatomy, the chapter on wood chemistry follows. The chemistry of cellulose and lignin, including the modern concepts of these sciences, are presented in a very clear way. The recent advances in knowledge about the accessory constituents of wood are included, partly in the form of tables.

The most important single items of the technological part are the pulp and paper industries. Besides other industries naturally belonging to the wood chemistry field, the related subjects of, for example, glues and glueing, surface treatment of wood, wood preservation and board materials of various types are also included. In the last chapter a number of preparatory and analysical experiments are described.

The concise manner of presentation and the great number of tables and illustrations make this book easy to read. Numerous references to sources of detailed information are given at the end of each chapter.

The text will thus provide the student with comprensive up-to-date information and, mainly because of the economic considerations, it will also serve as a thought-provoking survey for many other categories of readers. As the book has few counterparts, it is hoped that translation into other languages will be considered.

The Transportation of Pulpwood in Flumes. W. D. Bennett. p. iv+141. illus. Pulp and Paper Research Institute of Canada. Montreal, 1956.

The use of flumes for the transportation of pulpwood is today confined mainly to a relatively small area in eastern Canada.

Under certain conditions, however, and for certain purposes, flumes, over the years, have proved to be the most efficient and economical means of wood transport. Their restricted use at present may be due, at least in part, to a lack of knowledge about them.

It is the purpose of the above report, issued by the Pulp and Paper Research Institute of Canada, to describe the advantages and disadvantages of flumes, their areas of application and their costs of construction and operation, in such a way that an intelligent appraisal of their merits may be made in comparison with other more conventional means of pulpwood transportation.

The following are some of the points made by the report:

1. Temporary flumes need not be expensively engineered and constructed, and may be built and operated economically for very short periods.

2. In metal flumes the semicircular (or parabolic) shape seems to possess the best hydraulic and woodcarrying properties, with economy in construction.

3. The most important phase of flume operation is feeding or loading. Care must be taken not to overload the flume, and to avoid fluming oversize, forked, or deformed logs with the general run of pulpwood.

4. The economics of flume operation are almost wholly dependent on the conditions prevailing in its proposed location. Where water is available and conditions seem to favor its use, its demonstrable economies would seem to make it worth considering in competition with other methods of transportation.

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Quarterly FAO/ECE Market Review. Available from UN Sales Agents		
Possibilities for the Development of the Pulp and Paper Industry in Latin America 1954, 142 pp. (ES). Joint study by ECLA and FAO	1.50	11s.
Pulp and Paper Prospects in Latin America 1955, 466 pp. (E). Published jointly by ECLA, TAA and FAO	19.50	4.50 32s.
European Timber Trends and Prospects Geneva 1953,316 pp. (EF). Published jointly by FAO and ECE.	14.00	3.50 25s.
European Timber Statistics 1913-1950 Geneva 1953, 30 pp. (EF)	7.00	1.75 12s.6d.
Paper for Printing: Today and Tomorrow Paris 1952, 139 pp. (ES). Published jointly by UNESCO and FAO	1.25	7s.6d.
World Pulp and Paper Resources and Prospects New York 1954, 102 pp. (ES; F mimeographed). Published jointly by UN and FAO	1.25	6s.3d.

OCCASIONAL PAPERS

(*Mimeographed*)

Wood Burning 1955, 58 pp., illustrations (EFS). Free on application		
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Directory of Wheel and Track-type Tractors Produced throughout the World 1955, 372 pp. (Trilingual)	3.00	15s.
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Control of Brush and Undesirable Trees 1957, 50 pp. (E. FS in prep.). Free on application		
The Oxford System of Decimal Classification for Forestry 1954, 116 pp. (E). Available only from Central Sales Branch, Commonwealth Agricultural Bureaux, Farnham Royal, England.		10s.

The initial letters between parentheses indicate English, French and Spanish editions.

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